1967

Minimum Resource Requirements for Specified Levels of Income in Faulk County, South Dakota

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MINIMUM RESOURCE REQUIREMENTS FOR SPECIFIED LEVELS OF INCOME IN FAULK COUNTY, SOUTH DAKOTA

BY

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A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Major in
Economics, South Dakota
State University

1967

MINIMUM RESOURCE REQUIREMENTS FOR SPECIFIED LEVELS OF INCOME IN FAULK COUNTY, SOUTH DAKOTA

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Adviser Date

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ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Dr. Rex Helfinstine for his guidance and suggestions throughout this study.

Special thanks are extended to Professor John Sanderson for his contributions to this thesis as well as his advice and guidance over the past two years. The aid and encouragement of Dr. Wallace Aanderud is also greatly appreciated.

Although it is not possible to give full credit to the many other members of the Economics Department staff who freely gave advice and assistance whenever called on, their help is gratefully acknowledged.

This thesis is dedicated to the author's fiancee, Miss Susan Junod, whose patience, understanding, and encouragement was especially appreciated. Finally, special thanks are due to the author's parents, Mr. and Mrs. Charles Umberger, for their encouragement and assistance throughout the author's undergraduate and graduate programs.

The Economics Department survey referred to in this study was taken in central South Dakota as a part of State Research Project No. 423 of the South Dakota Agricultural Experiment Station. Dr. R. D. Helfinstine is the Project leader.

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CHAPTER I

INTRODUCTION

Statement of the Problem

The purpose of this study is to determine combinations of agricultural resources and enterprises required to obtain specified farm income levels in Faulk County, South Dakota. The income level of the farmer in Faulk County depends on the cuantity and quality of the resources controlled and the efficiency achieved in utilizing these resources.

The level of farm income in Faulk County is often inadequate to meet both the requirements of the farm firm and the needs or desires of the operator and his family. Many farmers are making adjustments to increase their income levels. An indication of the adjustments being made by farmers in Faulk County can be gained by noting the change from 1959 to 1964 in the following items:[1]

Item	1959	1964
Total Number of Farms	602	528
Average Size of Farm (Acres)	1,005	1,138
Value of Land and Buildings:		
Average per farm	$42,970	$64,611
Average per acre	$42.25	$56.11

Some farmers are moving to more remunerative nonfarm employment, and many of those who stay on Faulk County farms are reorganizing them into larger units.

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[1] U.S. Census of Agriculture: 1964, preliminary report for Faulk County.

Farmers who have a need or desire to raise their income level must decide on farm or non-farm employment. When the farmer and his family desire to employ their labor and other resources in agriculture they need to know the amounts and kinds of resources required to enable them to earn specified incomes.

From both a farm and community standpoint the specific income level a farmer may desire is important in that this income may be a minimum needed to keep his resources in agriculture. When farmers leave a community both the remaining farmers and the rest of the community are forced to make adjustments.

Objectives

This study has the following specific objectives:

1. To determine the combination of farm enterprises consistent with the minimum resource estimates for specified income levels and environmental conditions in Faulk County, South Dakota.
2. To determine the minimum resource requirements needed to obtain specified returns to operator labor and management with selected technical, institutional, and economic conditions.
3. To determine the effects of changes in return to land on the minimum resource requirements needed to attain specified returns to operator labor and management.

4. To compare the minimum resource requirements needed to attain specified returns to operator labor and management for alternative livestock enterprise combinations.

Description of the Area

Faulk County, located in central South Dakota, has a climate with extremes of summer heat, winter cold, and rapid fluctuations of temperature.[2] Additional problems of low average annual rainfall and wide variations in annual rainfall supports the placement of Faulk County in the high risk area for production of dryland crops. Annual precipitation at the Faulkton station has averaged slightly below 18 inches for the past 45 years. During various years, precipitation has ranged from ten inches to more than 27 inches.[3]

Faulk County soils lie on an undulating glacial plain which gradually becomes less undulating from west to east.[4] Claypan soils and poorly drained soils are more common in the western area of Faulk County. This helps to account for the slightly lower percentage of suitable cropland in the western area of the county.

Two major soil regions are found in Faulk County. Roughly, the western half of the county lies in the Chestnut Region and the

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[2]See Figure I.

[3]U.S. Weather Bureau Records, (1921-1965).

[4]Fred C. Westin, Leo F. Puhr, and George J. Buntley, Soils of South Dakota, Soil Survey Series Pamphlet No. 3, Agronomy Department, Agricultural Experiment Station, South Dakota State College: Brookings, South Dakota, March, 1959.

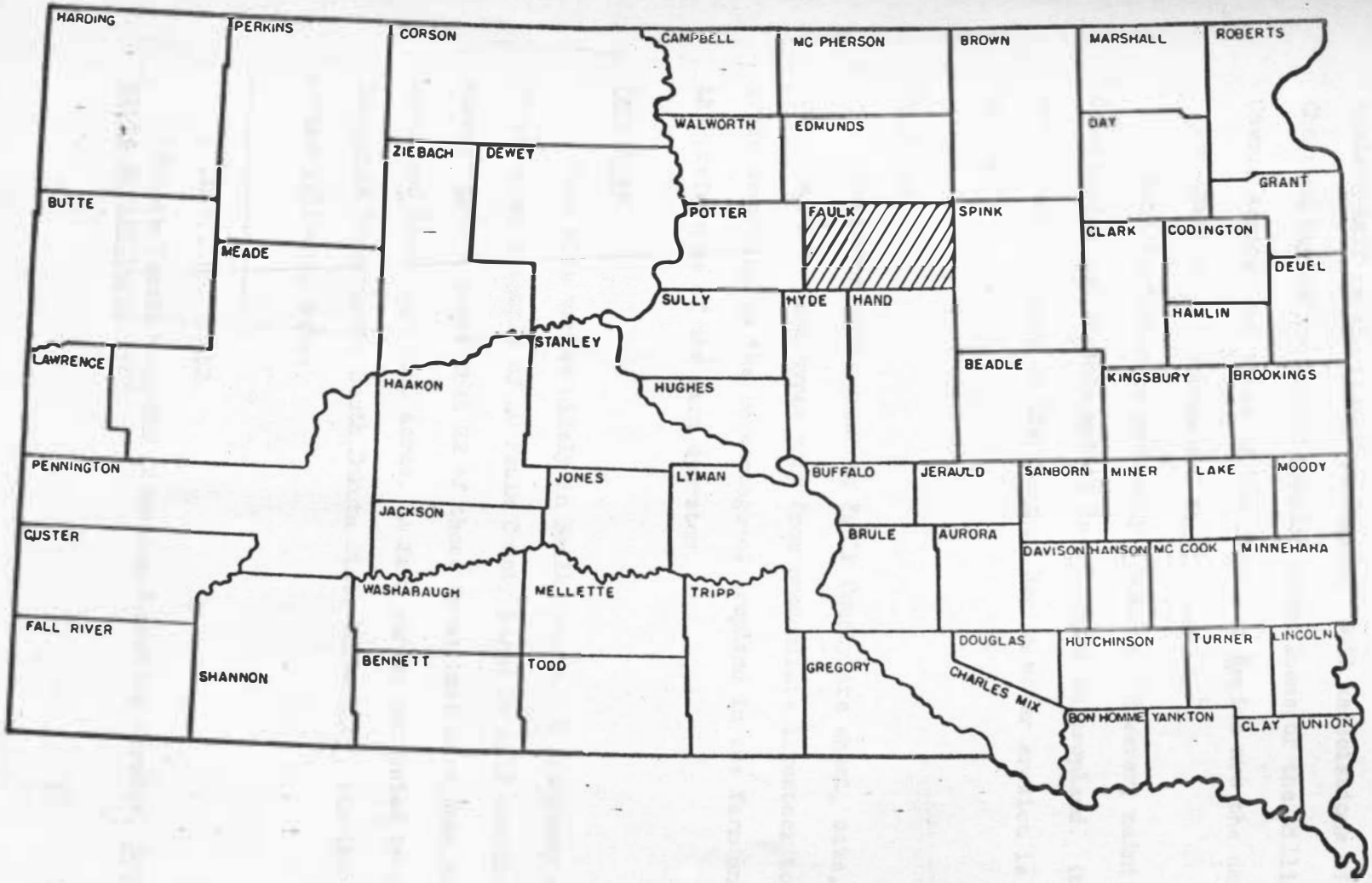

Figure I. Location of the area included in the study

eastern half in the Chernozem Region. Soil associations of the Chestnut Region are mainly grayish brown loams of the Williams-Cavour series, and those of the Chernozem Region are the dark grayish brown loams of the Houdek and Bonilla series.[5]

Soil fertility is generally adequate. However, maintenance of nitrogen and organic matter is a problem on cropland. On a portion of the land in the Chestnut Region water erosion is a hazard.

Land Use

The major crops grown in Faulk County are wheat, oats, corn, and alfalfa.[6] Farm types vary from predominate livestock to cash-grain depending on the percentage of cropland in the farm unit and the preference of the farm operator.

Farm Size

Farm size varies widely in Faulk County. A frequency classification of a sample of 40 Faulk County farms by half section acreage groups shows that 22 of these farms have more than 800 acres and less than 1440 acres. A farm survey conducted by the Economics Department, South Dakota State University, was the source of the following data:

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[5]Ibid., pp. 10-12.

[6]South Dakota Crop and Livestock Reporting Service, South Dakota Agriculture, 1965.

Acres	Number of Farms
480 - 799	4
800 - 1119	11
1120 - 1439	11
1440 - 1759	11
1760 - 2079	4
2080 - 2399	7
2400 - 2800	2
Total	40

The personal interview survey was taken during the summer of 1965.

CHAPTER II

DEVELOPMENT OF THE CONCEPTS

Few studies have considered income levels as a goal of the farm firm. Most studies using the theory of the firm assume profit maximization as a goal and show the optimum combination of resources and enterprises to attain this goal.

Much of the initial work in determining the minimum resource requirements needed for specified income levels was done by Brewster. In 1957, Brewster undertook a study to determine the minimum complements of resources needed to attain specified income levels for farm operators.[1] In a paper presented to the Southern Farm Management Research Committee, Brewster discussed many of the methodological questions involved in a minimum resources study and outlined many of the detail assumptions and the general framework to be used in a study of this type. He considered four general topics:[2] (1) The attributes of the income requirement, (2) the values to be minimized, (3) the construction of resource situations to be considered, and (4) an empirical example. The selection of income levels used in this study was based on suggestions found in Brewster's study.

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[1]John M. Brewster, "Analyzing Minimum Resource Requirements for Specified Income Levels", Farm Size and Output Research, Southern Cooperative Series Bulletin No. 56, Oklahoma Agricultural Experiment Station: Stillwater, 1958, pp. 95-104.

[2]Ibid., p. 95.

Most recent minimum resource studies have followed the general guidelines furnished by Brewster. Varley and Tolley argued that the approach known as "resources needed for specified income levels" aims for farm organizations giving a return to operator labor and management similar to what could be earned in non-farm employment.[3] They state that this approach is desirable for two reasons:[4]

1. It aims at an appropriate policy goal, and
2. This is the direction farmers are likely to be pushed by market forces in the long run.

Their recommended procedure for an analytical study was "... to assume a specified level of return to the operator's labor, capital, and management with a residual return imputed to land."[5] The analytical procedures used in this study are based on those suggested by Varley and Tolley.

Work by Connor refined the analytical procedures suggested by Varley and Tolley in order to develop and examine potential long-run adjustments for farm operators in the Panhandle region of Oklahoma.[6] Connor found that "... the hypothesis that farmers

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[3]A. P. Varley and G. S. Tolley, "Simultaneous Target Planning for Farms and the Area", Journal of Farm Economics, XLIV (1962), pp. 979-991.

[4]Ibid., p. 979.

[5]Ibid., p. 991.

[6]Larry Jean Connor, Long-Run Adjustment Hypothesis for Farm Operators in a Sparsely Populated, High-Risk Area of the Great Plains, (unpublished Ph.D. thesis), Oklahoma State University: Stillwater, Oklahoma, 1964.

acquire some minimum amount of resources sufficient to obtain an acceptable return to labor and management does not appear to be an adequate explanation of the trend in farm size by itself."[7] More plausible explanations of present and prospective farm sizes appeared to be different adjustment hypotheses recognizing the effects of owned resources, alternative yield expectations, and the interaction of these items.

Many of the Oklahoma farm operators "... apparently choose farm plans which provide some acceptable return to their owned resources."[8] Connor's study required the formulation of several alternative models to test his hypotheses. The operational model used in this study is based on the one used by Conner.

Questioning operators who recently quit farming may indicate their reasons for making the adjustments often required to establish a different mode of life. In an Illinois study of 200 operators who had capital investment in machinery and equipment, Guither found that 75 percent had quit voluntarily.[9]

Of those forced to leave the main reasons given were: (1) health failure, (2) lack of income to meet family needs, (3) termination of the lease, (4) sale of farm, and (5) restriction of

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[7]Ibid., p. 126.

[8]Ibid., p. 127.

[9]Harold D. Guither, "Factors Influencing Farm Operator's Decisions to Leave Farming", Journal of Farm Economics, Vol. 45 No. 3 (1963), pp. 567-576.

credit and heavy debt. Of all operators who quit farming, one third said rising costs, declining prices and low incomes created financial problems and two thirds indicated this had some influence on their decision. Guither indicated that "... these operators either were not making enough money to meet farm expenses and family needs, found return on capital and labor was low or had the ability, training, or aptitude to qualify for higher paying off-farm employment."[10]

The most frequently mentioned advantages of the new employment were more and steadier income, more security, and easier physical work.

Guither concluded that many of the Illinois operators who quit farming lacked the capital and land resources to make an efficient and profitable farm unit.[11] Of those farmers whose reason for leaving was economic, a major financial problem was insufficient business volume or lack of land and capital resources to balance the available labor.

The Long Run

In a recent study Barnhill determined "... the long-run least-cost organization of all measurable production services needed to

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[10]Ibid., p. 575.

[11]Ibid.

obtain specified levels of earnings for the operator's labor and management."[12] Barnhill states that this goal differs considerably from the usual type of farm management problem. Instead of maximizing income with some resources at a fixed level the problem of minimizing cost for a given income presupposes a long-run planning situation with all resource quantities being variable.

Liebhafsky explained the long-run concept in the following manner:[13]

> The term "long-run" refers to a period of time sufficiently long to allow all of the economic variables in the problem to change except those which are related to the economic growth of an industry or of a group of industries and not of a single firm. In the case of the theory of the firm, for example, in the long run, all costs are allowed to vary, and thus there are no fixed costs. Consequently, the plant size is no longer fixed but becomes an additional variable in the problem...

Land, labor, and capital become variable resources and cannot be restricted to an individual firm. This does not imply that land is not limited to a specific agricultural area. What is implied is that the time period is long enough for changes in resources to be made. In order for all resources to be variable, sufficient time for transactions, for example of land, and changes in institutions must be allowed.

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[12]Harold E. Barnhill, Resource Requirements on Farms for Specified Operator Incomes, Agricultural Economic Report No. 5, U. S. Department of Agriculture: Washington, D. C., November, 1964, p. 40.

[13]H. H. Liebhafsky, The Nature of Price Theory, The Dorsey Press: Homewood, Illinois, 1963, pp. 155-6.

Income as a Goal

There is an ample supply of literature available questioning the usual assumption that the rational entrepreneur is one whose primary purpose is to utilize his resources in the production of various products so as to maximize profits.[14] After briefly summarizing some of this literature, Connor suggests that profit maximization may not be the only motive of this decision maker in agriculture.

> Within agriculture, some evidence that motives other than profit maximization exist is available. For example, many farm adjustment studies indicate that net returns to farmers can be increased with increases in farm size over quite a wide range. Farmers interested in maximizing profits would thus want to expand the size of farm to the limit of their managerial ability (assuming a limit on management in the area). Hence, with the assumptions of profit maximization, sufficient adjustment time, perfect knowledge of opportunities, and adequate managerial ability, there should not be any inefficiently organized farms of given sizes, except where short-run resource limits are effective constraints. Given time for resource adjustments, there should also not be any problems associated with marginal farms and less than full utilization of resources in agriculture.[15]

Since these problems do exist in agriculture, it may be "... reasonable to assume that motives other than profit maximization exist

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[14]For a brief stretch by several authors of some of the criticisms of this assumption and suggestions for other goals see Joseph W. McGuire, Ed., Interdisciplinary Studies in Business Behavior, South-western Publishing Company: Cincinnati 27, Ohio, 1962.

[15]Connor, pp. 20-21.

to some degree along with impediments such as lack of knowledge and resource limitations."[16]

In a static economy Connor's argument is a reasonable one for motives other than profit maximization in agriculture. However, in a competitive economy, under these assumptions, pure profit does not exist when these problems are solved.

In agriculture, as in other industries, changes do not take place under perfect knowledge. Neither do entreprenuers immediately possess the managerial ability to reorganize their firms to achieve the optimum in resource use.

When the structure of an industry is changing, time is always required before the marginal value productivities of mobile resources are equated. For agriculture, technology seems to be reducing the marginal value product of labor relative to the employment of other resources such as capital. Because demand is increasing only slowly for agricultural products the result is a labor surplus in agriculture.

The return to operator labor and management may represent the opportunity cost of employing this resource in agriculture or other areas of the economy. An entreprenuer may maximize profits by switching his resources out of agriculture. Many times the most mobile of resources is labor.

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[16]Ibid., p. 21.

Selection of appropriate income goals can be the dual of profit maximization in the long run. An income goal can aid the individual farmer in making decisions on the types of adjustments he needs to make in utilizing all his resources--land, labor, capital and management--in the production of products by the most efficient method. Income goals can indicate the long-run adjustments farmers and the farm firm are likely to make with other industries and with other firms within the area.

CHAPTER III

METHODS OF ANALYSIS

The analytical method used in this study employed linear programming to determine the minimum resource requirements needed for specified income levels.

Linear Programming

Linear Programming is a method of mathematical analysis whereby some objective function is minimized or maximized subject to various restrictions.[1] Any problem containing three main components may be expressed as a linear programming problem. The required components are:[2]

1. An objective;
2. Alternative methods or processes for reaching the objective; and
3. Restrictions, either on the resources or the products they produce.

However, the usefulness of a solution obtained by an application of the linear programming method to a problem will depend

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[1]Saul I. Gass, Linear Programming Methods and Applications, 2nd ed., McGraw-Hill Book Company, New York, 1964, p. 3.

[2]Earl O. Heady and Wilfred Caudler, Linear Programming Methods, Iowa State College Press: Ames, Iowa, 1958, pp. 2-4.

on how well the problem conforms with the assumptions of linear programming. The basic assumptions used in linear programming are:[3]

1. Linearity: Which restricts variables to the first power, thus only "straight line" relationships are employed in linear programming. This means that input-output coefficients used are assumed to be constant, or are represented by a linear relationship between the factor input and product output, and the prices paid for resources or prices received for products do not change with the volume of output.
2. Additivity: This means that the activities or processes must be additive, i.e. when two or more are used, their total product must be the sum of their individual products.
3. Divisibility: Which means that factors can be used and commodities produced in quantities which are fractional units. Resources and products are assumed to be continuous infinitely divisibles.
4. Finiteness: This means that there is a limit to the number of alternative activities and to the resource restrictions which need to be considered.

The technique is carried out by stating the problem in the form of a mathematical model using linear equations. The complete mathematical statement of the problem includes a set of simultaneous

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[3]Ibid., pp. 17-18.

linear equations which represent the conditions of the problem and a linear function which expresses the objective of the problem.[4]

In order to illustrate the mathematical model for determining the minimum resource requirements needed for specified income levels, the income level of the operator, the resource restrictions, and the admissable enterprises must be given. Assuming the objective is to minimize, for example the land input, the minimum resources problem may be summarized as follows:[5]

Minimize the amount of land

$$(1) \quad f = \sum_{j=1}^{n} c_j x_j, \text{ with } x_j \geq 0,$$

where c_j is the quantity of land required per unit of the $_j$th product and x_j is the quantity of the $_j$th product produced. The linear statement of the objective is subject to the resource restrictions

$$(2) \quad a_{ij} x_j \leq b_i, \; i=1, \ldots, m,$$

where a_{ij} is the quantity of the $_{ij}$th input required per unit of the $_j$th product, b_i is the amount of the $_i$th restricted input and m is the number of restricted inputs. Some income level, B, is sought for use of the minimum amounts of resource.

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[4]Gass, p. 3.

[5]The basic model was first suggested by Varley and Tolley, pp. 985-6. A model similar to the one in this study is found in Conner, p. 42.

The income requirement is

$$(3) \quad \sum_{n=1}^{j} r_j x_j = B,$$

where r_j is the net revenue from the production of one unit of the $_j$th product and B is the specified income level.

The Selected Criterion

The quantity of land was the resource factor minimized in this study. However, any of the three factors of production (land, labor, or capital) might be chosen as the criterion to use for minimizing the resource requirements needed to attain the specified given income level.[6] The question of what values should be minimized is answerable only with a very definite idea of the problem situation. Very specific assumptions must be made concerning what factors are fixed in order to select the necessary criterion.[7]

Given the problem objectives, the criterion selected minimizes the quantity of the chosen factor so as to attain the desired level of income with the most profitable quantity of the other resources and the minimum quantity of this chosen factor. Other resources will be used to the point where their marginal value products equal their prices.

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[6] Brewster, p. 99.

[7] Ibid.

In a minimum resource study conducted in the Panhandle area of Oklahoma, land was chosen as the factor to be minimized because of the following reasons:[8]

(1) Land was the critical factor in the conceptual model in this study;

(2) Land prices were extremely difficult to estimate;

(3) Land is a major factor of production in the agricultural sector;

(4) Land is limited in quantity in a particular area; and

(5) The solution obtained should be similar to those for a minimum capital criterion.

Similar reasons can be given for choosing land as the factor to be minimized in this study. In Faulk County, land is probably the least mobile of the three factors of production and presently has the smallest opportunity to be used outside the agricultural sector compared to other resources in this particular area. Labor was not chosen as the factor to be minimized since there is no reason to believe the supply is fixed for the area.

Minimizing capital might be used as the criterion equation since many farmers in this area are restricted by the amount of capital they can borrow or control. However, since land investment comprises a large proportion of total investment results should be

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[8]Connor, p. 43.

similar. Moreover, a high interest rate on capital will tend to restrict the amount used and cause a shift to those enterprises which give a higher return per dollar invested.

Income Levels

For the purposes of this study the meaning of income levels is "return to operator labor and management". Return to operator labor and management implies that all other resources are paid their market prices. The selected income level is then an opportunity cost of using labor and mangement in farming.[9]

Return to operator labor and management may or may not be the same as disposable income to the farm family. Family disposable income is a "... residual to owned resources after rented or borrowed resources are paid their market prices and annual cash and overhead costs are paid."[10] Thus disposable family income may be greater than the return to operator labor and management when resources are owned.

The number and range of income levels that conceptually can be selected is a continuum. However, management capabilities and economies of scale will place upper limitations on the income range.

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[9]Larry J. Connor and Odell L. Walker, "Minimum Resource Requirements for Specified Incomes; Clay-Loam Soils in the Oklahoma Panhandle", Oklahoma Current Farm Economics, Vol. 37, March, 1964, pp. 16-17.

[10]Ibid.

From a practical standpoint, only a few income levels could and need to be selected.

The question of what level of income to select is one of the more difficult problems in a minimum resource study. Brewster approached the problem of what income levels to select from a comparative welfare standpoint. He indicated there is a need by farm people to know the amounts and kinds of resources which are required in agriculture "... to enable farm operators with average ability to have levels of earning equal to the median earnings of semi-skilled workers in non-farm employments."[11] This knowledge would be advantageous to both farm and non-farm people since in a competitive economy the greatest total of goods and services is made available only when the earnings in all employments approach equality for the same kinds of production factors--land, labor, and capital.

The problem of income selection is complicated because identical money income comparisons between farm and non-farm workers are not real income comparisons. Ideally, the most appropriate income levels are "... industrial worker earnings adjusted for differences in the purchasing power of money, cost of living, and values of non-money income items so that any given level would represent equivalent quantities of want-satisfying goods in both farm and non-farm modes of life."[12] In actuality only rough comparisons can be made.

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[11]Brewster, p. 96.

[12]Ibid., p. 98.

The income levels selected for this study were 3,000 dollars, 5,000 dollars, and 10,000 dollars. These incomes may represent variations which exist in skills and training among operators. They may also represent goals of different operators or society goals. A recent government report indicates that a family with an income below 3,000 dollars is living in poverty.[13] Table 1 gives the average annual earnings of production and nonsupervisory workers in selected industries in the United States and South Dakota.

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[13]U.S. Department of Agriculture, Poverty in Rural Areas of the United States, Agricultural Economics Report No. 63 (Washington, D.C., November, 1964).

Table 1. Average Annual Earnings of Production or Non-supervisory Workers for Selected Industries in the United States and South Dakota, 1964

Item	Average Annual Earnings U.S.[a]	Average Annual Earnings South Dakota[b]
	Dollars	Dollars
Selected Industries:		
Contract construction	6,867	5,947
Motor Freight Transportation and Warehousing	6,353	6,364
Mining	6,131	5,499
Fabricated Metal Products	6,057	4,626
Communication and Electric, Gas and Sanitary Services	5,998	4,966
Paper and Allied Printing[c]	5,821	5,292
Wholesale Trade	5,333	4,842
Food and Kindred Products	5,083	6,026
Lumber and Wood Products	4,451	4,556
Banking	3,987	3,273
Retail Trade[d]	3,637	3,522

[a]U.S. Department of Commerce, Survey of Current Business, Office of Business Economics (Washington, D. C., July, 1965).

[b]U.S. Department of Labor, Employment and Earnings Statistics for States and Area, 1939-1964, Bureau of Labor Statistics, (Washington, D.C., June, 1965), pp. 537-540.

[c]Also Printing, Publishing and Allied Industries.

[d]Except eating and drinking places.

CHAPTER IV

ASSUMPTIONS OF THE MODEL

The use of linear programming in problem analysis requires that the assumptions of the model be explicitly stated. The assumptions of the model in this study are specified and explained in the following sections.

Resource Restrictions

Land

Since land was chosen as the criterion to be minimized, the number of acres in the farm model was determined by the programming process. In order to have a representative farm situation, it was necessary that each acre be representative of a typical acre in Faulk County. The assumed percentage composition of an acre of agricultural land among pastureland, cropland, and other uses is given in Table 2. The division is based on a report by the State Soil and Water Conservation Needs Committee of South Dakota.[1]

Cropland was divided into four classes. The division was based on management problems that arise when the land is used for cropping purposes. The physical capabilities and limitations of land primarily determine the management practices needed to maintain yield levels and conservation of soil and water resources.

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[1]The South Dakota Conservation Needs Committee, South Dakota Soil and Water Conservation Needs Inventory, May, 1962.

Table 2. Assumed Percentage Composition of an Acre of Farmland, Faulk County

Item		Percent
Cropland Composition:		
Class a	10.4	
Class b	20.9	
Class c	9.5	
Class d	2.6	
Total Cropland[a]		43.4
Native Hay or Pasture		12.5
Rangeland		39.8
Other: Farmstead, Roads, Trees, Fences, and Wasteland		4.3
Total		100.0

[a]Based on present use as determined by Economics Department survey.

Source: Adapted from The South Dakota Conservation Needs Committee, South Dakota Soil and Water Conservation Needs Inventory, May, 1962, p. 43.

Definitions of the assumed cropland classes used in this study are as follows:[2]

1) Class a land includes all capability-class II land except that portion subject to erosion. This class represents 24 per cent of all cropland and in general is the most favorable land for cropping purposes.

[2]Briefly, a land-capability unit is a group of soils that are nearly alike in potential for agricultural use, plant growth, and response to similar treatment and management. For a more complete definition of the land-capability classes and subclasses see the South Dakota Soil and Water Conservation Needs Inventory, pp. 88-94.

2) Class b land includes capability-class IIe and IIIe land where "e" indicates erosion may play a role in limiting the use of this land. Some conservation practices such as terracing and/or selection of crop rotations are required on this land. This class represents 48 per cent of all cropland.

3) Class c land consists of capability-class IIIs land where "s" refers to unfavorable soil conditions. Soil limitations in the root zone are a major problem and must be constantly considered in any cropping sequence or selection. Class c represents 22 per cent of all cropland.

4) Class d land includes capability-class IVw and Vw where "w" refers to excess water problems. Very careful management is required when these soils are used for cultivated crops. This class is representative of six per cent of the total cropland in the county.

Wheat allotments used in this study were based on ASC reports for 1966 and average allotments as determined by a survey of Faulk County farmers. Only one wheat restriction was used in this study. The farm manager is assumed to desire to quality for price supports under the conditions of the wheat program for 1966.

Labor Assumptions

The representative farm model used in this study was assumed to be a family farm. However, only operator labor was considered

available for farm use. The total operator labor available is 3000 man-hours per year. The assumed annual overhead labor requirement was 900 man-hours.

The operator labor directly available for productive purposes was divided into five periods as follows:

1) Period one, November 16 to March 15, was allocated 508 hours of operator labor;
2) Period two, March 16 to April 30, was allocated 210 man-hours;
3) Period three, May 1 to July 15, was assumed to have available 493 hours;
4) Period four, July 16 to September 30, was allocated 583 hours; and
5) Period five, from October 1 through November 15, was allocated 306 hours of operator labor.

These five periods are intended to be representative of the different rush periods of farm and ranch work in Faulk County. The average dates for cropping operations in Faulk County are shown in Table 19 of the appendix.

Additional labor could be hired in each of the five periods as needed at a cost of $1.25 per hour. Hired labor may not always be available as needed at this wage rate. However, family labor can often be substituted for all or part of the hired labor requirement.

One of the most influential factors in determining the amount of labor used on both crop and livestock farms is the degree of mechanization. Factors other than the degree of mechanization also influence the total labor required for a given level of earnings. The price-cost ratio influences the labor requirements. Custom work can substitute for operator and other hired labor. Custom hiring is less expensive than owning the equipment when the size of the job to be done is too small to spread the machine overhead cost over several units of output.

In this study, stack moving was considered to be custom hired. On Faulk County farms, machine size and cost can generally be varied to match requirements for profitable ownership of machinery. Thus, custom hiring is generally used only for specialized jobs such as cattle spraying or for crops grown on a small acreage.

Capital

The amount of capital available to the firm was assumed unrestricted if the return on its use is greater than the interest charge. Thus, capital can be borrowed as long as returns to the firm exceed or equal the assumed market rate of interest. All operating capital was charged seven per cent interest. The market rate of interest on land investment was 5.5 per cent. This is the approximate current market interest rate.

Capital was divided into total and annual capital. Annual capital was assumed to be the average annual investment for the established farmer. Total capital indicates the outlay a farmer

would need to start farming. Interest was charged only on annual capital. Thus, annual capital represents the opportunity cost of farming in this model.

Land accounts for a major portion of the total capital requirement of the farm firm. Information from various sources indicate the 1964-65 average land price in Faulk County was approximately 60 dollars per acre. The sources included 1964 census data and information obtained from the Federal Land Bank Association serving Faulk County.

Buildings, Machinery, and Equipment

No substantial investment in buildings was required for any of the enterprises included in this study. The average building investment required for the various livestock enterprises was allocated to that particular enterprise. Investment in storage facilities was assumed to be included in the land price.

The assumed investment and cost requirements for machinery alternatives are shown in Table 14 of the appendix. Operating costs for the machinery used in this study are based on the assumption that the machine is used enough to wear out during its useful live. Where feasible, depreciation was charged to crop activities at the minimum wearout rate. Machine costs which could not be allocated to a particular crop activity or on a per acre basis were added to the income requirement.

Livestock equipment costs were allocated on a use basis to individual livestock enterprises. Most farms in Faulk County have available stock tanks, feed bunks, salt boxes and other livestock equipment. Investment and costs for special equipment, such as portable feeding facilities for hogs, were charged to the enterprise requiring the equipment.

Overhead Costs

Costs that could not be allocated to any particular enterprise but varied with the number of acres in the farm are shown in Table 15 of the appendix. These costs were assumed to be interest on land, land tax, a portion of the liability insurance, and depreciation and maintenance on fences.

Some costs do not vary with farm size or are constant over wide ranges of farm size. These costs could not be allocated to a particular enterprise or charged on a per acre basis, but were added to the income requirement. Table 16 of the appendix gives a summary of these costs.

Enterprise Alternatives

The production possibilities allowed in the linear programming model of this study are shown in Table 23 of the appendix. The number of production activities included in this analysis was necessarily limited by the finiteness of the operational model and particularly by the machine capacity available. Also, production activities were restricted by the climate and physical characteristics

of the area, and the limited markets for specialized crops. Thus, the activities considered when deciding on the combination of farm enterprises consistent with the minimum resource requirements for specified operator income levels were typical or recommended processes for the area.

Crop Activities

Admissible crop enterprises in various rotations were wheat, corn grain, corn silage, oats, flax, barley, and alfalfa hay. Reseeding cropland to native grasses and native and tame grass mixtures was not considered because of the general lack of information on risk in obtaining suitable stands and potential yields.

All activities allowed on cropland were rotations as no continuous crop sequences are recommended for the area. Very few farmers in the area are found to use continuous one-crop systems. Rotations were selected on the basis of recommendations by agronomists and those usual in the area as determined by personal interview survey.

Livestock Activities

A total of 12 livestock activities were considered as production alternatives. A cow-calf enterprise, assuming a 92 percent calf crop with one sixth of the cows replaced annually, was included in the model. Average annual salable products are one sixth of a 1000 pound cull cow and 76 percent of a 430 pound calf. Calves are assumed to be weaned the latter part of October.

Other livestock enterprises consist of feeding steer calves on alternative rations and weights and for varying lengths of time. The stocker enterprise winters a 430-pound calf on a ration of either silage or grain plus hay. The yearling calf is then placed on pasture until it weighs 700 pounds in late summer.

The four calf feeding activities allow 430-pound steer calves to be obtained in October, wintered, and fed in drylot with or without silage at a rate sufficient to allow sale of a choice 1050-pound steer the following October. Pasturing calves for approximately three months was considered as an alternative to continual drylot feeding. However, the marketable product would then be a 1100-pound choice steer.

The only hog enterprise in the model consisted of a gilt with 7.5 pigs weaned per litter. Pigs are farrowed in the spring and sold as 225-pound market hogs the following fall. One gilt is retained for replacement purposes. Portable farrowing and feeding facilities are used in this enterprise.

Buy, Sell, and Feeding Activities

Feeder calves were allowed to be bought or sold. Feeder calves could be either bought or raised and then transfered into the stocker activities or the fed yearling activities. Stocker steers could be sold or transfered into the yearling feeding activities. Also included in the model was the opportunity to buy stocker steers.

Two activities allowed the possibility of purchasing 700-pound yearling calves in October and selling 1100-pound choice steers the following April. Two other activities allowed feeding of yearling calves year around by purchasing 700-pound steers after selling the choice steers.

Other activities allowed labor to be hired for each of the five labor periods. Either native or alfalfa hay could be fed, but a hay selling activity was not included. Oats, corn and barley could be either fed or sold. In addition, selling activities were included for wheat and flax. Land buying was the final activity in the model.

Budgeting Assumptions

Budgets were developed for each of the production activities considered in the model. The budgets were based on the assumption that improved technological and management levels are used in Faulk County. Survey information indicated that Faulk County farmers currently use some of the recommended practices included in the budgets. Other practices included in the study and not currently used by most farmers are likely to be adopted by a majority of farmers within five to ten years.

For instance, the yields levels used in this study are slightly above the average reported for the county. However, these yields can easily be obtained by farmers who adopt recommended cropping practices and are being realized by the better farmers.

The assumed yields used in this study are found in Table 17 of the appendix.

The assumptions used in the cost and returns schedules developed for each of the production activities came from a number of sources. Predicted crop yields and application rates for fertilizer, herbicides, and insecticides for the area were developed for NC-54 and GP-5 research projects.[3] However, adaptations of this data were required to fit the more localized conditions of this study.

The set of assumptions concerning the input-output relationships for livestock activities also was similar to that used in NC-54. Furthermore, this set of assumptions appeared realistic for this study.

The assumed prices paid and received in this study are shown in Table 13 of the appendix. These prices are not forecasts, but represent an estimate of future prices that are internally consistent on a relative basis.

An example of the initial programming model including input-output coefficients is given in Table 24 of the appendix. Restrictions and activities are identified in appendix Tables 22 and 23, respectively.

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[3] The data used in these two research projects were developed by Professor John Sanderson based on figures supplied in consultation with staff members of the Agronomy Department at South Dakota State University.

CHAPTER V

MINIMUM RESOURCE MODEL WITH NONLAND BASED LIVESTOCK ENTERPRISES

The purpose of this chapter is to examine and evaluate the minimum resources which are required to obtain specified levels of operator income with selected livestock purchase activities. Farmers in Faulk County may want sufficient resources to attain a desired income level and insure firm survival. The minimum resource requirements needed to obtain specified returns to operator labor and management may indicate the adjustments farmers in Faulk County are likely to make.

Adjustments depend on known technical, institutional, and economic conditions within and outside agriculture. Current technology applicable to Faulk County farms, current support programs, and 1966 acreage allotments for wheat were assumed in this study. Only owner-operator situations are considered in this chapter. Programming techniques were used to find the least-cost combination of resources needed to represent three specified opportunity cost levels of using labor and management in farming.

Estimated Minimum Resource Requirements

The estimated minimum resource requirements needed to earn a 3,000 dollar, 5,000 dollar, and 10,000 dollar return to operator labor and management are shown in Table 3. The table includes:

(1) total land and acres of different crops, (2) types and sizes of livestock enterprises, (3) hours of operator labor, (4) investment in land, buildings, machinery and equipment, (5) the total operating capital, (6) gross sales, and (7) the general classes of expenses. However, only total land, labor, capital, and gross income are analyzed in this chapter.

The total land requirement to earn a 3,000 dollar return to operator labor and management was 1,016 acres; the total labor requirement was 3,122 hours; and the total capital requirement was 100,136 dollars. Land, the factor mimimized in this study, accounted for over 60 percent of the total capital.

Average annual gross income needed to earn a 3,000 dollar return to operator labor and management amounted to 34,109 dollars. Of the programmed gross sales, 91 percent originated from selling 119 fat cattle. These cattle were bought as calves and fed out.

As expected, an increase in the specified income level resulted in an increase in minimum resource requirements. A 5,000 dollar return to operator labor and management required a minimum of 1,613 total acres of land. The total labor requirement was 4,269 hours; and the total capital requirement amounted to 155,546 dollars. Land investment accounted for 63 percent of the total investment. Again, 90 percent of the gross sales were fat cattle receipts with wheat and flax sales the remainder.

To earn a 10,000 dollar return to operator labor and management required 3,280 total acres of land, 7,146 total hours of labor and

297,578 dollars total capital. Land investment accounts for 66 percent of the total capital requirement. Fat cattle sales were 80 percent of the 97,902 dollar gross income figure; hogs were seven percent, and wheat and flax sales 13 percent.

All crops except barley appeared in one or another of the various rotations composing the final solution. However, oats could be replaced by barley with only a small change in the resource requirements or price ratio.

The rotations included in the final solution varied with the land class, and the income level. The class a cropland included corn-wheat and corn silage-wheat for all three income levels. For the class b cropland the rotations selected by programming were corn-oats for the 3,000 dollar and 5,000 dollar income levels, and corn-oats and corn-wheat for the 10,000 dollar income level. The class c cropland rotation included wheat-corn-flax and three years of alfalfa for all three income levels. Class d cropland consisted of a rotation that included one year of flax, one year of wheat and one year of fallow for all three selected levels of return to operator labor and management.

The wheat allotment proved to be a restriction only at the 10,000 dollar income level. At all other income levels, other resources restricted the number of wheat acres.

Labor requirements varied seasonally. It was profitable to hire labor during periods two and three at all three income levels. Period three, May 1 to July 15, was the period when the largest

amounts of labor were hired. Although operator labor was not employed during all periods, hiring labor on a seasonal basis proved profitable for two reasons:. Some tasks require more than one man for efficient performance, and some seasonal tasks must be performed within a relatively short period of time. Labor hired by periods and income levels follow.

Labor Period	Unit	Return to operator labor and management $3,000	$5,000	$10,000
November 16 to March 15	hour	0	0	150
March 16 to April 30	hour	128	320	793
May 1 to July 15	hour	229	654	1,676
July 16 to September 30	hour	0	271	929
October 1 to November 15	hour	0	116	547

Indicated Adjustments

Assuming that the programmed minimum resource requirements given in Table 3 are indications of the actual requirements for specified incomes, economic pressures for adjustments in both size and organization of Faulk County farms are present. Given the combination of farm resources found in Table 3, a farm-operator can earn a 3,000 dollar return to operator labor and management on a below average size farm--using land as a measure of size.[1] With

[1]The average size of Census farms in 1964 was 1,138 acres.

Table 3. Estimated Minimum Resource Requirements to Obtain Specified Returns to Operator Labor and Management with Specified Non-land Based Livestock Enterprises, Faulk County.

Item	Unit	Return to Operator Labor and Management $3,000	$5,000	$10,000
Total Land	Acre	1,016	1,613	3,280
Cropland	Acre	442	701	1,424
Corn	Acre	166	264	628
Oats	Acre	106	168	224
Barley	Acre	0	0	0
Wheat	Acre	78	124	370
Flax	Acre	25	39	80
Corn Silage	Acre	9	15	4
Alfalfa	Acre	49	77	213
Native Hay	Acre	75	119	179
Livestock				
Feed Calf: Drylot-Silage	Animal	36	58	16
Feed Calf: Pasture-No Silage	Animal	83	131	279
Gilt and Litter	Animal	0	0	21
Labor				
Operator	Hour	2,765	2,901	3,000
Hired	Hour	357	1,368	4,146
Investment				
Land and Buildings	Dollar	64,044	101,637	206,742
Machinery and Equipment	Dollar	11,640	14,732	19,621
Total Operating Capital	Dollar	24,452	39,177	72,288
Total Capital Requirement	Dollar	100,136	155,546	298,651
Gross Income	Dollar	34,109	54,320	98,766
Operating and Overhead Expense[a]	Dollar	25,583	40,039	71,925
Return to Land[b]	Dollar	3,352	5,323	10,824
Machinery Fixed Costs	Dollar	3,246	3,958	6,017
Return to Operator Labor and Management	Dollar	3,000	5,000	10,000

[a]Includes seven percent interest charge on all annual capital except land.

[b]Assumes a current land price of 60 dollars and a 5.5 percent interest rate on land investment.

an increase in the desired operator earnings, minimum resource requirements increase rapidly. For instance, at the 5,000 dollar income level the total land requirement increases by 597 acres, or 59 percent, over the 1,016 acres required for a 3,000 dollar income. If 10,000 dollars is considered the income target, the required land acreage, when compared to the 3,000 dollar income level, more than triples.

This rapid increase in minimum resource requirements corresponds with only slight changes in the enterprise combination of programmed farms at different levels of operator income. Increased operator earnings could be achieved by adding resources in a nearly proportional manner, especially when the increase was from the 3,000 dollar to the 5,000 dollar income level. However, some reorganization of both crop and livestock enterprises was noted at the 10,000 dollar operator earning level. Both corn and wheat increased in proportion to other crop enterprises; and the hog enterprise appeared in the final solution as a partial replacement to feeding calves in drylot.

When compared to the average farm, as shown by the 1964 Census, the programmed farm allocated a slightly larger percentage of total crop acreage to corn production. Small grain acreage other than wheat was replaced by corn acreage. The larger percentage of crop acreage devoted to corn production, compared to the Census farm, may be due to the type of libestock enterprises included in the final solution of the model.

The greatest difference between the organization of the programmed farm and a typical present farm organization in Faulk County is found in a comparison of livestock enterprises. The least-cost organization of production resources included only livestock activities which bought calves and sold choice fat cattle. Very few farmers in Faulk County presently engage in similar livestock enterprise practices.[2] Cattle and other livestock feeding enterprises have disadvantages as they require large amounts of capital and a high level of management, and incur much risk.

Besides these disadvantages, a limiting factor to general livestock feeding for Faulk County and the immediate area may be a possible shortage in the supply of calves and feed at the assumed cost-price ratio. However, both feed grains and unfinished livestock products are presently being exported from the area.[3] Further, in the programmed model feed grains were not allowed to be bought so that only the number of livestock for which feed was available could be fed.

A restriction (in the short-run at least) to cattle feeding in the area may be lack of available capital or credit for this purpose. Agricultural credit institutions may be reluctant to loan money for cattle feeding when neither they nor the potential feeder have little

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[2]See Chapter VII.

[3]Rex D. Helfinstine, "Our Changing Competitive Position", Managing Change in the Livestock Industry of South Dakota, Economics Pamphlet 124, Economics Department, Agricultural Experiment Station, South Dakota State University, 1965, pp. 48-53.

previous knowledge of probable profits and risks). Owner-operators may have little desire to invest money into an operation they consider risky and/or have little management knowledge. More research knowledge is needed on farmer and lending agencies in this area. But for those farmers who have or can acquire the needed capital and management, and do not discount heavily for risk (good management can reduce risk) livestock feeding may offer a method to attain desired income levels with the least-cost combination of resources.

If farmers desire a return to operator labor and management above 3,000 dollars, farm size is likely to continue to increase in terms of both land and other resources employed. Operators who desire to receive labor and management returns comparable to what they could earn in non-farm employment (an indication that this return is above 3,000 dollars is shown in Table 1) are likely to attempt to make necessary adjustments. The programmed results in this chapter indicate that the most efficient adjustments in terms of resources, excluding management, may include both increases in size and in reorganization of enterprises for a number of farm-operators in Faulk County.

CHAPTER VI

THE EFFECTS OF CHANGES IN LAND PRICE ON THE ESTIMATED MINIMUM RESOURCE REQUIREMENTS

Many farmers in Faulk County own all or part of their land. Farmers who have an investment in land and other resources can use the return received from these owned resources to increase family disposable income or for other purposes, such as farm expansion and weathering the bad years.

Results in the previous chapter of this study indicated that land investment accounted for 60-66 percent of total capital requirements. Hence, changing the return to land should indicate the nature of the effect owned resources can have on the minimum resource requirements for specified income levels. It is assumed that in the long run and in a competitive economy all resources will have a tendency to adjust until their marginal value products among alternative employments are equal.

In this chapter programmed changes were made in interest rates or returns to land. If the land is assumed to be operator-owned a change in the interest rate is equivalent to a change in the land price. That is, an equal percentage change in either the interest rate or return to land will have the same effect on land price.

The base land price used in this study was 60 dollars--the approximate current average price of an acre of agricultural land

in Faulk County. The market rate of interest was 5.5 percent. Three changes were made in the base land price (interest rate).

The three changes made were to 0, 50, and 125 percent of the assumed market interest rate or of the assumed return to land. That is, land prices of zero, 30, and 75 dollars are compared with the 60 dollar base land price. Equivalent interest rates would be 0.0 percent, 2.75 percent, and 6.875 percent compared with the assumed market interest rate.

The 75 dollar land price is a projected land price based on previous rates of increase in land prices. This projected land price may be reached in five to ten years.[1] Also, an interest rate of 6.875 percent is comparable to the annual payment by a farmer who purchased land on a 30 year repayment plan, assuming a progressive type of principal payment.

The estimated minimum resource requirements for the three changes in return to land are shown in Table 5 for a 3,000 dollar return to operator labor and management; Table 6 for a 5,000 dollar return, and Table 7 for a 10,000 dollar return.

The farmer who owns his land and requires no return on it can earn a 3,000 dollar return to operator labor and management with 578 acres, 5,000 dollars with 836 acres, and 10,000 dollars with a minimum of 1,564 acres. The farmer who invested only 30 dollars

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[1]According to statistics found in the U.S. Census of Agriculture, the estimated current market value of farm land and buildings increased from 24 dollars per acre in 1950 to 42 dollars in 1959, and 56 dollars per acre in 1964.

an acre in his land or is willing to accept a 2.75 percent rate of return on the estimated current value can earn a 3,000 dollar return to operator labor and management with 728 acres; 5,000 dollars with 1,081 acres, and 10,000 dollars with 2,131 acres. The results for the 30 dollar land price are similar to those obtained under the assumption that the farmer owns 50 percent of the total land he operates and pays a rent equal to the market return on the landlord's investment in land.

When the land price is 75 dollars (6.875 percent interest rate) 1,370 acres were required to earn a 3,000 dollar return to operator labor and management; 2,279 acres were required to earn a 5,000 dollar return, and 4,843 acres were required to earn a 10,000 dollar return to operator labor and management.

Similar changes in other resource requirements were noted as land prices or the required returns to land were varied. Table 4 shows the percentage change in total land, total labor, total capital, and gross income when land prices vary from the base price.

Table 4. Percentage Change in Estimated Minimum Resources Needed for Specified Return to Operator Labor and Management when Returns to Land Vary From the Assumed Market Returns, Faulk County

Return to Operator Labor and Management	Selected Resource Measures	Percent change in resource requirements when land prices change to:[a] $0	$30	$75
		percent	percent	percent
$3,000				
	Total land	-44	-38	+35
	Total labor	-27	-16	+32
	Total capital	-39	-23	+34
	Gross income	-36	-16	+35
$5,000				
	Total land	-48	-33	+41
	Total labor	-38	-25	+29
	Total capital	-47	-31	+37
	Gross income	-48	-32	+37
$10,000				
	Total land	-52	-35	+48
	Total labor	-43	-27	+48
	Total capital	-49	-32	+52
	Gross income	-46	-27	+50

[a]The assumed basic land price was 60 dollars and the interest rate 5.5 percent. The base resource requirements are given in Table 3.

Table 5. Estimated Minimum Resource Requirements for 3,000 Dollar Return to Operator Labor and Management for Specified Land Prices, Faulk County

Item	Unit	Land Price per Acre[a] $0	$30	$75
Total Land	Acres	578	728	1,370
Cropland	Acres	251	314	599
Corn	Acres	100	113	224
Oats	Acres	91	114	143
Barley	Acres	9	11	0
Wheat	Acres	4	6	106
Flax	Acres	4	6	22
Corn Silage	Acres	0	13	13
Alfalfa	Acres	28	35	65
Native Hay	Acres	66	70	101
Livestock				
Feed Calf-Drylot - No Silage	Animal	41	0	0
Feed Calf-Drylot-Silage	Animal	0	50	49
Feed Calf, Pasture - No Silage	Animal	42	56	111
Labor				
Operator	Hour	2,285	2,485	2,839
Hired	Hour	2	144	1,284
Investment				
Land and Buildings	Dollar	2,133	24,564	106,859
Machinery and Equipment	Dollar	9,260	9,850	14,602
Total Operating Capital	Dollar	15,431	20,394	33,076
Total Capital Requirement	Dollar	26,829	54,808	154,537
Gross Sales	Dollar	21,940	27,900	46,143
Operating and Overhead Expense[b]	Dollar	17,204	20,887	33,828
Return to Land[c]	Dollar	0	1,201	5,651
Machinery Fixed Costs	Dollar	2,375	2,813	3,664
Return to Operator Labor and Management	Dollar	3,000	3,000	3,000

[a]Assumed current land price is 60 dollars.

[b]Includes seven percent interest charge on all annual capital except land.

[c]Five and one-half percent interest charge on land investment.

Table 6. Estimated Minimum Resource Requirements for 5,000 Dollar Return to Operator Labor and Management for Specified Land Prices, Faulk County

Item	Unit	Land Price per Acre[a] $0	$30	$75
Total Land	Acres	836	1,081	2,279
Cropland	Acres	363	475	992
Corn	Acres	137	172	387
Oats	Acres	87	123	238
Barley	Acres	0	10	0
Wheat	Acres	64	73	177
Flax	Acres	7	26	56
Corn Silage	Acres	8	11	6
Alfalfa	Acres	40	52	109
Native Hay	Acres	62	82	135
Livestock				
Feed Calf-Drylot-Silage	Animal	30	43	22
Feed Calf-Pasture-No Silage	Animal	68	87	192
Gilt and Litter	Animal	0	0	26
Labor				
Operator	Hour	2,477	2,751	3,000
Hired	Hour	169	438	2,505
Investment				
Land and Buildings	Dollar	2,519	35,771	178,489
Machinery and Equipment	Dollar	10,650	11,850	15,382
Total Operating Capital	Dollar	19,630	26,647	53,490
Total Capital Requirement	Dollar	32,799	74,268	247,261
Gross Income	Dollar	28,154	36,966	71,019
Operating and Overhead Expense[b]	Dollar	20,101	6,851	51,744
Return to Land[c]	Dollar	0	1,784	9,401
Machinery Fixed Costs	Dollar	3,053	3,331	4,874
Return to Operator Labor and Management	Dollar	5,000	5,000	5,000

[a]Assumed current land price is 60 dollars.

[b]Includes seven percent interest charge on all annual capital except land.

[c]Five and one-half percent interest charge on land investment.

Table 7. Estimated Minimum Resource Requirements for 10,000 Dollar Return to Operator Labor and Management for Specified Land Prices, Faulk County

Item	Unit	Land Price per Acre[a] $0	$30	$75
Total Land	Acres	1,564	2,131	4,843
Cropland	Acres	679	925	2,104
Corn	Acres	255	349	836
Oats	Acres	163	222	506
Barley	Acres	0	0	0
Wheat	Acres	120	163	371
Flax	Acres	38	63	718
Corn Silage	Acres	15	19	0
Alfalfa	Acres	75	102	213
Native Hay	Acres	116	155	256
Livestock				
Feed Calf-Drylot-Silage	Animal	56	72	0
Feed Calf-Pasture-No Silage	Animal	127	173	413
Gilt and Litter	Animal	0	2	74
Labor				
Operator	Hour	2,895	3,000	3,000
Hired	Hour	1,213	2,227	7,557
Investment				
Land and Buildings	Dollar	4,676	70,387	379,735
Machinery and Equipment	Dollar	14,705	14,928	30,824
Total Operating Capital	Dollar	37,820	52,041	714,273
Total Capital Requirement	Dollar	57,201	137,356	524,832
Gross Income	Dollar	52,667	71,344	146,871
Operating and Overhead Expense[b]	Dollar	39,046	53,234	108,962
Return to Land[c]	Dollar	0	3,515	19,976
Machinery Fixed Costs	Dollar	3,621	4,595	7,976
Return to Operator Labor and Management	Dollar	10,000	10,000	10,000

[a]Assumed current land price is 60 dollars.

[b]Includes seven percent interest charge on all annual capital.

[c]Five and one-half percent interest charge on land investment.

CHAPTER VII

THE EFFECTS OF CHANGES IN LIVESTOCK ENTERPRISES ON THE ESTIMATED RESOURCE REQUIREMENTS

A comparison of the previous programming results with present farms and ranches in Faulk County indicates that gross income was relatively high for the programmed farms.[1] Most of the gross sales from the programmed farms resulted from the sale of fat cattle, which were bought as calves. Only when a 10,000 dollar return to operator labor and management was required or land priced at 75 dollars did other livestock activities enter the final solutions.

Very few farmers in Faulk County presently have as their only livestock enterprise buying calves and feeding them to fat cattle weights. A recent survey of 40 Faulk County farmers and ranchers showed only one farmer with a fat cattle operation and one farmer who combined a swine enterprise with cattle feeding. A total of 37 of the 40 farmers had a beef cow herd. Of these 37, only 11 fed calves to sell either as stocker or as fat cattle. Several farmers combined a beef cow herd with hogs or sheep or with both hogs and sheep. Some farmers were quite diversified and had a beef cow herd,

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[1]According to the 1964 Census of Agriculture less than 8 percent of the farms in Faulk County in 1964 had gross incomes over 20,000 dollars, while the gross income was greater than 20,000 dollars on all programmed farms included in Chapters V and VI.

hog enterprise, sheep enterprise and feeder cattle. Only six of the 40 farms had a beef cow herd as the only livestock enterprise.[2]

Faulk County is in a high risk area for the production of crops and livestock. Rainfall, crop production, and prices show large fluctuations from year to year. Production of fat cattle is generally considered to be a "risky" enterprise. The combination of these factors might produce incomes that have large annual variations from the programmed models. It is conceivable that a combination of bad weather, high factor input costs and low prices for the salable products could result in a very low income available to the operator or a net loss to the firm for one or more sequential years.

Many farm operators in Faulk County apparently try to diversify their operations in an attempt to reduce variations in their annual incomes. Also, some farm operators may prefer one type of livestock enterprise or combination of enterprises over others; and they may be willing to reduce their income potential in order to state their preference.

Alternate Model Formulations

In order to study the effects of changes in livestock enterprises on the minimum quantity and allocation of resources three

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[2]Economics Department Survey of Faulk County.

alternative models were formulated. The three alternative model formulations were as follows:

(1) First, the opportunity to buy feeder calves or stockers was removed from the "original model."[3] This alternative is called model B for the purposes of identification in the tables of this chapter.

(2) Secondly, the hog enterprise in addition to (1) was removed from the original model presented in Chapter V. This alternative is called model C.

(3) The third model allowed only a beef cow herd for livestock enterprises. This model is identified as model D.

The results of the programs for a 60 dollar land price and a 3,000 dollar return to operator labor and management are shown in Table 9; and the results for a 5,000 dollar return to operator labor and management is shown in Table 10. Three alternative model formulations were also programmed for the situation where no return is required on investment in land. Table 11 shows the results of the zero return to land situation for a 3,000 dollar return to operator labor and management; and Table 12 gives the results for the 5,000 dollar operator earnings level.

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[3]The model presented in Chapter V which included buy-sell feeder systems will be referred to as the "original model".

The effects of the changes in livestock enterprises on total land, total labor, total capital and gross income were varied for the zero return to land situation and the opportunity cost of land situation. The percentage change from the original estimated minimum resources needed for specified levels of operator earnings for both situations is shown in Table 8.

Table 8. Percentage Changes from Original Estimated Minimum Resources Needed for Specified Levels of Operator Earnings for Selected Alternative Livestock Models; Market Return to Land and No Return to Land[a]

Return to Operator Labor and Management	Selected Resource Measures	Percent change from original requirement with livestock system:[b] B	C	D
	Market Return to Land Assumed[c]			
$3,000				
	Total land	+33	+156	+501
	Total labor	+20	+ 52	+207
	Total capital	+33	+117	+393
	Gross income	-21	+ 38	+134
$5,000				
	Total land	+39	+195	+592
	Total labor	+20	+ 86	+292
	Total capital	+45	+153	+477
	Gross income	- 4	+ 23	+169
	When Land Price or Return to Land is Zero[d]			
$3,000				
	Total land	+ 5	+ 50	+ 63
	Total labor	+ 9	+ 11	+ 7
	Total capital	+12	+ 31	+ 34
	Gross income	-33	- 38	- 41
$5,000				
	Total land	+ 7	+ 48	+ 59
	Total labor	+17	+ 12	+ 5
	Total capital	+16	+ 33	+ 34
	Gross income	-24	- 31	- 37

[a]Original model included selected livestock purchasing activities.

[b]A description of the livestock systems in this table is given on page

[c]Original estimated minimum resource requirements are given in Table 3.

[d]Original estimated minimum resource requirements are given in Table 5 (3,000 dollars) and Table 6 (5,000 dollars).

Table 9. Estimated Minimum Resource Requirements for a $3,000 Dollar Return to Operator Labor and Management for Specified Livestock Systems and 60 Dollar Land Price, Faulk County

Item	Unit	Model B	Model C	Model D
Total Land	Acre	1,349	2,604	6,109
Cropland	Acre	586	1,131	2,654
Corn	Acre	243	307	721
Oats	Acre	141	130	305
Barley	Acre	0	0	0
Wheat	Acre	103	294	690
Flax	Acre	34	157	371
Alfalfa	Acre	64	124	292
Native Hay	Acre	79	124	289
Livestock				
Beef Cow and Calf	Animal	34	67	204
Feed Calf: Pasture-No Silage	Animal	26	51	0
Gilt and Litter	Animal	50	0	0
Labor				
Operator	Hour	3,000	3,000	3,000
Hired	Hour	758	1,757	6,574
Investment				
Land and Buildings	Dollar	86,943	160,201	374,606
Machinery and Equipment	Dollar	15,002	18,154	32,028
Total Operating Capital	Dollar	31,413	39,096	88,479
Total Capital Requirement	Dollar	133,358	217,451	494,113
Gross Income	Dollar	26,911	47,173	79,804
Operating and Overhead Expense[a]	Dollar	14,462	30,634	47,640
Return to Land[b]	Dollar	4,452	8,593	20,158
Machinery Fixed Costs	Dollar	3,651	4,946	9,006
Return to Operator Labor and Management	Dollar	3,000	3,000	3,000

[a]Includes seven percent interest charge on all annual capital except land.

[b]Five and one-half percent interest charge on land investment.

Table 10. Estimated Minimum Resource Requirements for a 5,000 Dollar Return to Operator Labor and Management for Specified Livestock Systems and 60 Dollar Land Price, Faulk County

Item	Unit	Model B	Model C	Model D
Total Land	Acre	2,246	4,760	11,164
Cropland	Acre	976	2,068	4,850
Corn	Acre	388	563	1,318
Oats	Acre	235	238	557
Barley	Acre	0	0	0
Wheat	Acre	173	539	1,261
Flax	Acre	58	290	678
Alfalfa	Acre	107	227	529
Native Hay	Acre	129	227	529
Livestock				
Beef Cow and Calf	Animal	57	123	372
Feed Calf: Pasture-No Silage	Animal	43	93	0
Gilt and Litter	Animal	110	0	0
Labor				
Operator	Hour	3,000	3,000	3,000
Hired	Hour	2,127	4,950	13,754
Investment				
Land and Buildings	Dollar	146,928	292,854	684,597
Machinery and Equipment	Dollar	16,378	27,920	49,480
Total Operating Capital	Dollar	61,632	73,630	163,888
Total Capital Requirement	Dollar	224,938	394,404	897,965
Gross Income	Dollar	52,259	67,740	145,862
Operating and Overhead Expense[a]	Dollar	35,095	39,648	89,496
Return to Land[b]	Dollar	7,412	15,706	36,841
Machinery Fixed Costs	Dollar	4,752	7,386	14,525
Return to Operator Labor and Management	Dollar	5,000	5,000	5,000

[a]Includes seven percent interest charge on all annual capital except land.

[b]Five and one-half percent interest charge on land investment.

Table 11. Estimated Minimum Resource Requirements for a 3,000 Dollar Return to Operator Labor and Management for Specified Livestock Systems and No Return to Land, Faulk County

Item	Unit	Model B	Model C	Model D
Total Land	Acre	607	869	941
Cropland	Acre	264	377	408
Corn	Acre	105	150	162
Oats	Acre	95	59	64
Barley	Acre	0	0	0
Wheat	Acre	15	98	106
Flax	Acre	15	21	23
Alfalfa	Acre	29	41	45
Native Hay	Acre	39	59	45
Livestock				
Beef Cow and Calf	Animal	15	28	32
Feed Calf: Drylot-No Silage	Animal	0	21	0
Feed Calf: Pasture-No Silage	Animal	12	0	0
Gilt and Litter	Animal	37	0	0
Labor				
Operator	Hour	2,481	2,479	2,394
Hired	Hour	5	57	54
Investment				
Land and Buildings	Dollar	36,420	52,140	54,460
Machinery and Equipment	Dollar	11,185	11,310	11,230
Total Operating Capital	Dollar	17,373	14,961	12,896
Total Capital Requirement	Dollar	68,843	80,058	81,851
Gross Income	Dollar	14,656	13,589	12,911
Operating and Overhead Expense[a]	Dollar	8,998	7,526	6,758
Return to Land[b]	Dollar	0	0	0
Machinery Fixed Costs	Dollar	2,658	3,063	3,753
Return to Operator Labor and Management	Dollar	3,000	3,000	3,000

[a]Includes seven percent charge on all annual capital except land.

[b]Five and one-half percent interest charge on land investment.

Table 12. Estimated Minimum Resource Requirements for a 5,000 Dollar Return to Operator Labor and Management for Specified Livestock Systems and No Return to Land, Faulk County

Item	Unit	Model B	Model C	Model D
Total Land	Acre	891	1,234	1,328
Cropland	Acre	387	535	577
Corn	Acre	154	213	157
Oats	Acre	140	84	66
Barley	Acre	0	0	0
Wheat	Acre	22	139	151
Flax	Acre	22	30	81
Alfalfa	Acre	43	58	63
Native Hay	Acre	57	84	63
Livestock				
Beef Cow and Calf	Animal	22	39	44
Feed Calf: Drylot-No Silage	Animal	0	30	0
Feed Calf: Pasture-No Silage	Animal	17	0	0
Gilt and Litter	Animal	54	0	0
Labor				
Operator	Hour	2,760	2,741	2,632
Hired	Hour	335	230	153
Investment				
Land and Buildings	Dollar	53,460	74,040	79,680
Machinery and Equipment	Dollar	11,525	12,900	12,750
Total Operating Capital	Dollar	25,892	21,245	17,642
Total Capital Requirement	Dollar	96,508	110,498	110,812
Gross Income	Dollar	21,496	19,296	17,642
Operating and Overhead Expense[a]	Dollar	13,409	10,899	8,850
Return to Land[b]	Dollar	0	0	0
Machinery Fixed Costs	Dollar	3,087	3,397	3,501
Return to Operator Labor and Management	Dollar	5,000	5,000	5,000

[a]Includes seven percent interest charge on all annual capital except land.

[b]Five and one-half percent interest charge on land investments.

Implications of Changes in Livestock Enterprises

An analysis of the alternative model formulations for the opportunity cost of land situation reveals that land requirements needed for both a 3,000 dollar and 5,000 dollar return to operator labor and management increase substantially as selected livestock enterprise possibilities are removed from farm resource combinations.[2] Some increase in land requirements was expected when profitable non-land based activities were excluded from the model as production possibilities. The extent and nature of increases in minimum resource requirements varied with the enterprises allowed in the model and with the required return to land.

When only the capacity to buy feeder calves and stockers (model B) was removed from the original model, resources--land, labor, and capital—increased as indicated in Table 8; but gross income was reduced slightly. The reduction in gross income was due primarily to lower quantities of purchased inputs requiring large amounts of capital, such as calves.

With the conditions of model B, numerous gilt and litter systems were included in the final results. The hog enterprise has an effect similar to purchases of calves and stockers on minimum resource requirements as it requires only small quantities of legume pasture. Providing feed grains can be bought, this enterprise

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[2]The opportunity cost of land situation assumed in this study allowed a return of 5.5 percent on a 60 dollar per acre land investment.

is essentially a nonland based activity. The possibility of buying feed grains was not considered for any models in this study since the selected resource minimized was land. If feed grains were allowed to be bought, the probability exists that only feedlot facilities would be needed to earn required income levels. This possibility is feasible for only a very few operators but not as a representative situation in a study of this type.

In model C, a hog enterprise was no longer considered a production possibility. The minimum resource requirements were again increased compared to the original model (and model B) for both the 3,000 dollar and 5,000 dollar return to operator labor and management. Livestock enterprises in the minimum-cost solution included a beef cow herd and feeder cattle. All progeny not used for replacement purposes were wintered, grazed on pasture the following summer, and fed to fat cattle weights.

Model C may offer a combination of livestock enterprises that meets the needs and wishes of many farm-operators to reduce the risk and uncertainty due to variations in crop and range yields. This model may come closer to estimating average farm size in Faulk County than one which allows livestock purchasing activities since it requires that all calves fed be raised on the representative farm.

When crop or forage and pasture yields are below average or expected yields due to bad weather conditions, lack of adequate feed supplies can become a management problem. Stock cow herds are not

readily subject to large annual changes in numbers by buying and selling. Calves can more easily be sold (bought) than stock cows if feed supplies are short (plentiful). Thus, a rancher or farm-operator with sufficient management capabilities, may find that a combination beef-cow herd and feeder cattle enterprise may require fewer resources and have less risk than a beef cow herd alone.[3] Risk is reduced since calves can be sold during several periods of the year if future feed supplies are expected to be short. Allotting a part of his pasture and feed supplies for cattle feeding may provide the farm operator a reserve against drought conditions.

A farm situation with only a beef-cow herd (model D) required the largest quantity of minimum resources, 11,166 acres for a 5,000 dollar income, to obtain a desired opportunity return to operator labor and management. This fact may indicate that when farm-operators in an area restrict (for economic or other reasons) the types of enterprises, so that both feed grains and livestock are exported, larger farm sizes are likely to result.

A high percentage of the gross income in model D resulted from sales of feed grains. Feed grain sales were expected in this model. In model C, however, almost half or 46 percent of the feed

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[3]Resource requirements in terms of land, labor and capital are likely to be smaller, but management requirements may be greater. However, management is difficult to measure and in this study no attempt is made to measure its real importance. The previous statement does not indicate that management plays no important role in the selection of the optimum combination of resources. The capabilities of the manager may be determinate in deciding which enterprise combinations to select.

grains grown were sold, although all calves raised on the farm were fed out. This indicates that on the average, assuming the conditions of the model are realistic, sufficient feed supplies may be available to fatten most of the calves grown in Faulk County. Of course, other enterprises, such as hog, sheep, and dairy, not included in this model will affect feed supplies.

Changes in the relative acreage of major crops were insignificant under alternative model formulations. Wheat allotments were a restriction for both model C and D; but did not prove to be a restriction in model B where relatively larger amounts of grain were fed to livestock. This may indicate that operators of farms producing feed grains in excess of farm consumption may desire a larger wheat allotment than assumed in this study. A farm with a larger wheat allotment would have profit advantages under the support price assumed in this study. Thus, commodity programs directly affect the type of farm programmed in models C and D of this study.

Results presented in this study indicate that when Faulk County farm-operators restrict themselves to land based enterprise combinations, increased resources are required to earn specified returns to operator labor and management. The increases in minimum resource requirements were especially large when both feed grains and unfinished livestock, such as feeder calves, were sold off the farm. Depending on specified income levels, comparisons of the results obtained from the original model in Chapter V with model D show that land requirements increase by more than five times; labor

requirements by 2-3 times, and capital requirements 4-5 times. Thus farms or ranches that limit livestock enterprises to a beef cow herd may need large land acreages to obtain desired returns to operator labor and management.

When the return to land was reduced to zero the percentage increases in minimum resource requirements for the alternative model formulations were considerably smaller than when a 5.5 percent interest rate was charged on land investment. For example, required land acreage for model D increased by 59 to 63 percent over the programmed results for the zero land price given in Chapter VI. The direction of the percentage increases in land, labor, and capital over the original model for the zero return to land are similar to the increased requirements in models B, C, and D for the market return to land situation, only proportionately smaller. Changes in the enterprises considered and the resulting enterprise combinations are the same for both the zero return and market return to land situation.

The results summarized in Table 11 and Table 12 indicate that the operator who owns his land and requires no return on it can earn a 3,000 dollar disposable income on 941 acres and a 5,000 dollar income on 1,328 acres with a beef cow herd as the only livestock enterprise (model D). These results should not be interpreted as meaning that a farmer who owns the programmed amount of land and has the required number of beef cows can expect an average annual operator earnings level of between 3,000 and 5,000 dollars. Only

if his land and other resources were of the same quality and the other specifications of this model are met by the operator would his income level be similar.

These results do indicate that the owner-operator who fails to recognize the opportunity cost of his land investment or is willing to forego the "cost" for agrarian or other reasons does not have the same economic inducements to change the organization and/or size of his farm as the operator who recognizes these costs. Other costs not entirely recognized in the model may be important in inhibiting changes when the need for increased income levels is not large. Enterprise changes often require additional investments in new facilities and equipment and result in depreciation losses on present investment in obsolete facilities and equipment. Expenses, due to feeding errors for example, are involved in learning to manage unfamilar enterprises. Psychological detriments may result from enterprise changes. A certain amount of risk and uncertainty is generally present in any change. Further, the livestock feeder may have a different value system than the rancher-producer. Additional research needs to be done on the attitudes of both producer and feeder.

In the long run, these barriers need not prove important restrictions to changes in enterprise combinations. The long-run may be a period of time sufficient to allow changes in both size and structure of the firm and changes in the knowledge and attitudes of its manager and the institutions serving him. The rhetorical

question of "how long is the long-run" has important implications here. Attitudes and expectations of profits and losses of alternate enterprise combinations can change only if sufficient knowledge is available to managers.

Certain conditions not discovered by the results of this study may make it easier to acquire the extra land and other minimum resources required for other enterprise combinations. However, if lack of management and risk are not important restrictions more present and future operators in Faulk County can consider livestock feeding as a possible least-cost method of increasing their income levels. Helfinstine has argued that South Dakota's low cost feed supplies can be exploited by using them to the greatest possible extent for fattening livestock.[4] This argument is supported for Faulk County by the results of this study.

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[4]Helfinstine, p. 43.

CHAPTER VIII

EVALUATION OF THE ANALYSIS

The purpose of this chapter is to evaluate the results of programming for meaningful implications concerning general farm adjustments in Faulk County. Following this are discussions of the limitations of the study and the need for further research.

Adjustment Implications

The results of this study indicate operators with incomes below desired levels have available two general methods for increasing returns to labor and management employed in agriculture. Farm income levels can be increased by employing larger quantities of resources with only slight changes in organization or the income level can be increased by reorganizing farms to include more intensive labor and capital using enterprises. However, present operators may find that some combination of the two general methods is the most feasible means of raising their income levels.

Most farmers have acquired the knowledge and skills required to operate a farm within a limited organizational range. Farmers may be concerned about failing under alternative forms of organization because of lack of knowledge on which to judge the outcome of different enterprise combinations. Established organizations also create obstacles to change since losses must often be taken on

current investments. The result of either condition may lead to low income levels in an otherwise changing economic situation.

Both of the previously stated conditions may reduce the rate of change in agriculture but will not eliminate adjustments to low income levels in the long-run. In a competitive economy, economic forces create a tendency for returns to labor and management to be equated in farm and non-farm uses.[1] Farmers aware of the opportunity cost of their mobile resources may find more profitable employment of these resources, often outside agriculture.

Assuming operators desire to maximize returns to their labor and management a number of developments may occur in Faulk County. In order to obtain units of the required size, the total number of farms are likely to decline because of continued demand for land resources. Although programmed results fall below the present farm sizes when no return is assumed on land, for certain tenure situations a return to land becomes necessary. The operator who does not own his land is generally required to make a rent payment that approaches the market return on land investment. And the operator who is currently purchasing land must make both interest and principal payments. In either case there must be sufficient income to meet both the expenses of the farm firm and withdrawals for family living.

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[1]Non-monetary returns may substantially influence this tendency. Some farm operators may attach high values to the "agrarian way of life", have work and area preferences or lack knowledge of other opportunities, and so on.

The continued demand for land appears to be associated with an increase in land prices. A number of factors may influence both increases in farm sizes and land prices. Land prices can influence farm size if farmers consider the opportunity costs of owned land resources. The higher the return to land desired the larger the farm size needed to cover specified costs and still leave sufficient family incomes. An indication that owner-operators may not require full opportunity returns to land and to operator labor and management was shown by programming results that approached present farm sizes only as land prices were decreased below assumed current levels. Yet, owner-operators may influence land prices in other ways. Operators who purchased land at below current prices can take advantage of increased land values to enlarge their credit base for buying more land. In this manner, current earnings on owned land may be partially capitalized by expectations of increased land prices.

The past trend in Faulk County has been toward higher land prices. Indications are that this trend is likely to continue. Wider adaptation of present or improved technology can have important effects on land prices. Larger equipment capacities may increase both land prices and farm sizes. The operator who owns equipment with excess capacity may see additional land as a means of increasing his income level. The extent of future land price changes will be influenced by nonagricultural factors such as price speculation and values attached to owning land.

Again, programming results to indicate the level of resources needed to earn desired operator incomes varies with enterprise combinations. If decision-makers in Faulk County place greater emphasis on livestock feeding activities, especially buy-sell feeder systems, increased land requirements will be relatively smaller than under continued enlargement of present farm organizations. Available feed supplies would allow a higher proportion of livestock grown in Faulk County to be fed to market weights. Increased storage facilities may prove a beneficial method of diminishing variations in annual supplies of feed grains.

Future changes in non-farm wage rates can influence farm sizes by causing variations in the opportunity costs of employing labor and management in agriculture. The wage paid to hired farm labor will also depend on non-farm employment opportunities, prevailing wage rates, and the amount of reserve labor available in the community. As farm numbers are reduced by expansions of farm size, the amount of reserve labor on smaller farms will eventually decrease. This reduction in the supply of farm labor will probably result in higher farm wage rates.

As the number of farms and farmers decline, rural communities and institutions serving them are forced to make adjustments. Rural trading and social centers have had to adjust to population and income changes in the past, and may realize that the impact of future change can be lessened with proper planning. Eventually businesses, schools, churches, and local governments may be reorganized to serve

larger areas. Federal and state agencies are offering to aid local area development committees in finding ways to increase incomes in several rural communities. One of the most beneficial investments in any long-run approach to the problem may come from educational expenditures. Although recognizing a problem is a necessary step in its solution, adequate tools and knowledge of how to use them are needed to solve the problem. Increasingly, adjustment problems are being recognized as community problems.

Limitations of the Study and the Need for Further Research

Except for land price variations, programmed results were determined for only one price-cost relationship. Although estimated to be predictive of future price-cost relationships the effects of variations in the relationship could not be indicated for different time periods. Slight price-cost changes, if misjudged, may have important effects on profits of certain buy-sell feeding systems. Variations can cause both large losses and gains resulting in a need for considerable financial support to survive several bad "breaks". Further research is needed on the effects of dynamic price variations and probable minimum levels of capital requirements.

Crop yields are hard to predict in Faulk County due to high variability in weather and climate. Although estimates of future yields were obtained from specialists exploration of some variation of these yields might prove useful in analyzing adjustments.

Further research might also be conducted to ascertain the reliability of input-output relationships concerning the production of various commodities.

This study was intended to serve only as a guide for selecting potential rather than probable long-run adjustments. Hence, none of the models considered may be the optimum size for a given farm situation. The final decision as to which is the better farm organization depends in part on the abilities and preferences of the farm operator and his family. The returns to operator labor and management are not the only criterion on which to base decisions. Farmers may be satisfied with returns on their owned resources sufficient for family income needs. Further research may be directed toward determining the impact of variations in owned resources on the equilibrium farm size for Faulk County.

The inclusion of off-farm work and part-time work could substantially reduce desired farm income levels and minimum resource requirements. Methods of acquiring capital and obtaining land were not considered in this study. Research is needed on attitudes of both farmers and credit institutions toward different operational changes and management of capital flows in firm growth. Finally, changes in any of the specified assumptions pertaining to technical, economic and institutional conditions may change the results and implications of this study.

CHAPTER IX

SUMMARY

The major purpose of this study was to develop and evaluate alternate estimates of future farm sizes and organization in Faulk County, South Dakota. The specific objectives were to determine for selected technical, institutional, economic, and environmental conditions the minimum combination of resources required to obtain specified levels of operator earnings; and to evaluate the effects of changes in returns to land and changes in livestock enterprises on the minimum combination of resources required to attain specified returns to operator labor and management.

The farm situations selected for the study were restricted to the dryland conditions of Faulk County. Each acre was divided among cropland, pasture, and other uses so as to represent a typical acre in Faulk County. The supply of labor available was 3,000 man-hours per year with 900 man-hours allocated to overhead management. If profitable, additional labor was hired at $1.25 per hour. Capital could be borrowed as long as the return imputed to it was equal to or greater than the assumed interest rate. The farm was assumed to be operator-owned.

The enterprises considered were typical or recommended processes for the area. Crop enterprises included corn, wheat, flax, oats, barley, and alfalfa in various rotations. Native hay was included as an activity. Livestock enterprises available as

production alternatives varied for different model formulations. In all cases a beef-cow herd was allowed in the model. In alternate model formulations selected feeder calf systems, stocker enterprises, and a hog enterprise were considered as production possibilities. Selected livestock purchasing activities were included in one model.

For all alternate model conditions the linear programming approach was used to determine the minimum resource requirements and enterprise combinations needed to earn specified returns to operator labor and management. The three levels of return selected were 3,000, 5,000, and 10,000 dollars. Land was the criterion minimized. Alternate assumptions about land prices and available enterprise combinations were considered in estimating least-cost resource requirements.

The assumed crop yields, allotments, and price ratios were the same in all phases of this study. However, land price variations of 0, 30, 60, and 75 dollars were employed to determine effects on resource requirements.

Alternate model formulations indicated the nature of the long-run effects different livestock combinations have on minimum resource requirements where different rates of return to land were assumed. The results of this study indicated that for all operator earnings levels, enterprise combinations allowing calves to be purchased and fed required the smallest amounts of minimum resources in terms of land, labor, and capital compared to other possibilities.

The needed land requirements for 3,000, 5,000, and 10,000 dollar income levels with 60 dollar land were 1,016, 1,613, and 3,280 acres respectively.

Variations in land prices (interest rates) also changed the required minimum resources. For instance, a decrease in land prices to zero resulted in a reduction of the required total acreage for all livestock systems to below average current farm sizes in Faulk County for the 3,000 and 5,000 dollar income levels.

Changes in the assumed livestock enterprises substantially affected the minimum combination of resource requirements. The largest resource requirements were noted when the only livestock enterprise included in the model was a beef-cow herd requiring 430-pound calves to be sold in the fall. Land requirements were quite high in this case. For instance, 11,164 acres were required to earn a 5,000 dollar return to labor and management at the current land price. With the inclusion of cattle feeding activities in the model, land requirements were reduced to 4,760 acres. When the hog enterprise was also included in the model, resource requirements were 633 acres greater than the minimum 1,613 acres required for the buy-sell feeder cattle system.

When the return to land was decreased the effect was to reduce the required percentage increase in resource requirements for alternate livestock systems. For instance, at a zero land price and a 5,000 dollar return to operator labor and management, the land

requirement for the beef cow herd was 1,328 acres compared to 836 acres for the buy-sell feeder system.

Thus, future farm size in Faulk County may readily depend on the feasibility and the extent different livestock feeding systems are employed by present and future operators. Farmers willing and able to accept less than assumed market returns on land investment have lower percentage reductions in requirements with changes in resource combinations than farmers who desire maximum returns on investment. The extent to which farmers sacrifice returns to owned land resources will affect both future farm size and reorganization.

In either case, increases in farm size and the corresponding decrease in the number of farmers will probably continue because of the demand for land resources and the tendency for equalization of earnings to labor and management in farm and non-farm sectors of the economy. (Certain non-monetary values associated with agriculture may influence the tendency toward equilibrium.) Both land prices and farm wage rates are likely to continue rising because of needs for larger units and the resulting reduction in the amount of slack labor on small farms. As the number of farms and farmers declines, rural communities and institutions will also be forced to make adjustments.

Further research is needed on the effects of different yields, and price-cost changes, including long-run and annual variations, on

minimum combinations of resources. There is a need for further research on ways and means of managing capital flows in a manner that allows farm sizes to increase to levels needed to obtain desired incomes.

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APPENDIX

Table 13. Assumed Average Prices Paid and Received by Farmers, Faulk County, South Dakota

Item	Unit	Price
		(Dollars)
Prices Paid:		
Seeds:		
Wheat	bu.	2.65
Barley	bu.	1.76
Oats	bu.	1.33
Corn (hybrid)	bu.	12.90
Flax	bu.	3.50
Alfalfa	cwt.	44.02
Livestock:		
Yearling steer purchased (April)	cwt.	23.26
Yearling feeder steer bought (October)	cwt.	23.08
Steer Calf bought (October)	cwt.	25.28
Gilt (breeding Stock)	unit	60.00
Labor	hour	1.25
Custom Rates:		
Combine, small grain	acre	3.50
Haystack moving	unit	6.00
Fuel and Lubricants:		
Gasoline	gal.	.25
Motor oil	gal.	1.25
Lubricant	lb.	.22
Prices Received:		
Crop products:		
Wheat	bu.	1.82
Oats	bu.	.53
Barley	bu.	.81
Flax	bu.	2.75
Corn	bu.	1.09

Table 13 continued.

Item	Unit	Price
		(Dollars)
Prices Received (continued):		
Livestock products:		
Choice steer sold (October)	cwt.	24.15
Choice steer sold (April)	cwt.	23.97
Yearling Stocker steer (October)	cwt.	23.08
Steer calf (October)	cwt.	25.28
Cull cow	cwt.	13.04
Market sows (farrowed once)	unit	54.57
Butcher hogs (late spring litter)	cwt.	15.82

Table 14. Estimated Operating and Ownership Cost of Machine Complement, 1280 Acre Farm, Faulk County

Machine	Years[a] Useful Life (Years)	Hours[b] Useful Life (Hours)	Average[c] Annual Investment (Dollar)	Annual[d] Fixed Cost (Dollar)	Per Acre[e] Annual Fixed Cost (Dollar)	Per Acre[f] Variable Cost (Dollar)
Tractor, 4 plow	20	12,000	2,400	473	.387	.97[g]
Tractor, 3 plow	20	12,000	1,825	359	.295	.92[g]
Moldboard Plow, 4-14"	15	2,500	438	112	.330	.103
Tandem Disc, 12'	20	2,500	416	91	.139	.027
Spike Tooth Harrow, 5 Section	25	2,500	81	16	.013	.004
Press drill-Fertilizer attachment, 10'6"	20	1,200	765	168	.594	.038
Boom Type Sprayer, 30'	15	1,000	225	46	.006	.008
Corn Planter, 4R	20	1,200	630	124	.409	.051
Corn Cultivator, 4R	20	1,200	472	103	.368	.036
Corn Picker, 2R	15	2,000	1,300	320	1.554	.187
Windrower-pto, 12'	18	2,500	450	104	.145	.080
Mower, 9'	18	2,000	292	67	.133	.095
Rake, Side Delivery	18	2,500	281	65	.123	.031
Loader and Attachments	15	2,500	540	136	.268	.225[g]
Combine, pto.	15	2,000	1,600	380	1.171	.197
Total			11,715	2,564		

[a]Estimates are based on results of a survey of Faulk County farmers and estimates by the American Society of Agricultural Engineers published in the 1965 Agricultural Engineers Yearbook.

[b]Estimates taken from the 1965 Agricultural Engineers Yearbook.

[c]Estimates based on Official 1965 Tractor and Farm Equipment Guide.

Table 14 continued.

[d]Interest on investment, depreciation, insurance and taxes.

[e]Estimates based on the assumption that the machine is used enough to wear out during its useful life, i.e. minimum cost estimates.

[f]Repair and service cost of machine only.

[g]Variable cost per hour.

Table 15. Assumed Per Acre Overhead Costs in the Model of this Study, Faulk County

Item	Cost
	(Dollars)
Interest on land[a]	3.30
Land Tax	.81
Insurance (liability)	.004
Depreciation and Maintenance, fences	.29
Total overhead cost per acre	44.04

[a]When assumed land price is 60 dollars and interest rate is 5.5 percent.

Table 16. Assumed Nonallocated Annual Overhead Costs for a 1280 Acre Farm, Faulk County

Item	Investment	Annual Cost
	(Dollars)	
Machinery Fixed Costs:		
Machine Set		1,145[a]
Pick-up Truck, 1/2 ton	1350	
Interest on investment		98
Depreciation		330
Gas, oil, and lubrication		265
Repairs		80
Insurance		60
License		20
Wagons (2) with hoist	430	92
Fuel Tank (300 gal.)	90	8
Tools and equipment	300	50
Miscellaneous:		
Telephone and electricity		175
Tax service and bookkeeping supplies		50
Insurance (liability and employee)		52
Total specified overhead costs		2,227

[a]Includes interest, insurance, and taxes from Table 14.

Table 17. Estimated Average Yields Per Acre Using Recommended Cropping Practices, By Land Class, Faulk County

Item	Unit	Yield by Land Class a	b	c	d	Weighted Average[a]
Crop:						
Corn	bu.	30	23	24	20	23.7
Corn Silage	cwt.	116	86	90	76	90.0
Oats	bu.	40	36	34	30	36.2
Barley	bu.	30	26	20	17	25.1
Wheat[b]	bu.	19	15.5	15	13	16.1
Wheat on fallow	bu.	21	17	16	14	17.5
Flax	bu.	11	9	10	9	9.7
Alfalfa Hay	bu.	1.6	1.3	1.1	1.3	1.3
Native Hay -- Estimated yield was .67 Ton						
Native Pasture -- Estimated yield was .55 AUM						

[a]The weighted average is the sum of the average yield for each land class times the percent that land class is of the total.

[b]Assumes wheat on row crop or small grain.

Table 18. Estimated Per Acre Labor Requirements and Seasonal Distribution for Selected Dryland Crops

Crop	Man-hours per acre[a] Total	Percent Distribution of Labor by Period[b] March 16 to April 30	May 1 to July 15	July 16 to September 30	October 1 to November 15
Corn grain	2.74	0	62	0	38
Corn silage	2.25[c]	0	76	24	0
Oats	1.65	32	10	58	0
Barley	1.65	32	10	58	0
Wheat[d]	1.65	34	10	56	0
Flax	2.79	19	35	46	0
Alfalfa hay	1.98[d]	0	52	45	3
Native hay	1.04[d]	0	0	96	4
Fallow	.81	0	0	100	0

[a]Tractor hours are approximately 10 percent lower.

[b]Distribution will vary if fall plowing is assumed.

[c]Does not include time for custom chopping and hauling.

[d]Does not include time for custom stack-moving.

Table 19. Average Dates for Selected Cropping Operations, Faulk County

Item	Date
Start field work	April 10
Start seeding spring wheat	April 16
Finish seeding spring wheat	May 10
Finish seeding oats and barley	May 17
Finish seeding flax	May 22
Plow for corn	May 17
Plant corn	May 24 to June 5
Small grain spraying	June 7
Row crop spraying	June 21
First row crop cultivation	June 14
Second row crop cultivation	July 12
Start summer fallow	June 14
First crop tame hay	June 14
Second crop tame hay	August 10
Harvest native hay	August 18
Swath spring wheat	August 10
Swath oats	August 5
Swath barley	August 6
Swath flax	August 20
Start cutting corn silage	September 14
Pick corn	October 1
Start fall field work	September 17 and continue into October

Source: Compiled by Erwin Ullrich from records of the Crop and Livestock Reporting Service.

Table 20. Assumed Per Acre Variable and Overhead Costs for Average Crop Yield, Faulk County

	Corn grain	Corn silage	Wheat	Wheat after fallow	Oats	Barley	Flax	Fallow	Alfalfa hay	Native hay
					(Dollars)					
Variable Costs:										
Tractor power	2.62	1.88	1.86	1.86	1.86	1.86	2.03	1.29	1.16	1.57
Repairs	.75	.44	.51	.51	.51	.51	.57	.04	.54	.25
Seed	1.81	1.81	2.65	2.65	2.05	2.20	2.62		1.10	
Chemical	2.45	2.45	.36	.36	.10	.30	.28	.36	.43	
Fertilizer	3.25	3.92	2.98	1.08	2.75	2.63	4.90		1.23	
Custom		6.00							1.25	1.20
Interest	.76	.94	.59	.45	.52	.53	.73	.05	.40	.14
Overhead Costs:										
Depreciation	2.69	1.61	2.03	2.03	2.00	2.00	2.37	.30	.98	.49
I. T. and S.[a]	.79	.45	.64	.64	.64	.64	.79	.06	.36	.18
Total specified costs	15.12	19.60	11.62	9.58	10.53	10.67	14.29	1.10	7.45	2.83

[a]Insurance, Taxes and Shelter.

Table 21. Specified Variable Costs and Capital Requirements per Unit of Livestock Enterprises, Faulk County

Item	Beef cow	Stocker steer-silage	Feeder steer-drylot	Feeder steer-pasture	Drylot yearlings period 1	Drylot yearlings period 1 and period 2	Gilt and litter
	Amount per head						
	(Dollars)						
Variable Costs:							
Supplement[a]	6.66	2.35	20.07	13.15	13.51	27.02	60.39
Veterinary	4.75	2.78	3.78	3.78	3.78	7.56	7.00
Taxes	4.56	2.17	2.17	2.17	3.23	6.49	1.20
Equipment	3.63	6.03	8.41	7.86	7.11	12.26	11.87
Total	21.40	14.33	30.70	26.96	26.63	51.33	80.46
Livestock	228.15	108.70	108.70	108.70	161.56	324.38	60.00
Building and Equipment	39.54	25.70	30.18	30.18	30.18	30.18	80.18
Capital[b]	289.09	148.73	169.58	165.85	218.57	405.89	241.26

[a]Protein, salt, and mineral requirements are for silage feeding. When silage was not included in the ration, protein requirements were smaller.

[b]Capital is the sum of total variable costs, livestock investment and average buildings and equipment investment.

Table 22. Resource Restrictions Used in Initial Tableau for Representative Farm Situation, Faulk County

Item	Row	Unit	Initial Level
Class a land	R01	Acre	0.0
Class b land	R02	Acre	0.0
Class c land	R03	Acre	0.0
Class d land	R04	Acre	0.0
Native Hay	R05	Acre	0.0
Native Pasture	R06	AVM	0.0
Wheat Allotment	R07	Acre	0.0
Period One Labor	R08	Hour	508.0
Period Two Labor	R09	Hour	210.0
Period Three Labor	R10	Hour	493.0
Period Four Labor	R11	Hour	583.0
Period Five Labor	R12	Hour	306.0
Total Capital	R13	Dollar	0.0
Annual Capital	R14	Dollar	0.0
Hay to Harvest	R15	Ton	0.0
Feed Grain Transfer	R16	CWT. C. E.	0.0
Wheat Transfer	R17	Bushel	0.0
Flax Transfer	R18	Bushel	0.0
Grain to Feed	R19	CWT. C. E.	0.0
Hay Equivalent	R20	CWT.	0.0
Silage	R21	CWT.	0.0
Calf Transfer	R22	Animal	0.0
Period One Yearling Transfer	R23	Animal	0.0
Period Two Yearling Transfer	R24	Animal	0.0
Livestock for Sale	R25	CWT.	0.0
Income Requirement	R26	Dollar	Varies

Table 23. Description of Activities Considered for Representative Farm Situation, Faulk County

	Activity Description	Unit of Measure
	Cropland	
	Class a Land Rotations	
P_{01}	Corn-wheat	Acre
P_{02}	Corn silage-wheat	Acre
P_{03}	Corn-barley	Acre
P_{04}	Corn silage-barley	Acre
P_{05}	Corn-oat	Acre
P_{06}	Wheat-oat-fallow	Acre
P_{07}	Wheat-wheat-fallow	Acre
P_{08}	Flax-wheat-fallow	Acre
P_{09}	Barley-corn-oat-alfalfa (3 years)	Acre
P_{10}	Wheat-corn-barley-alfalfa (3 years)	Acre
P_{11}	Wheat-corn-corn silage-oat-alfalfa (3 years)	Acre
P_{12}	Wheat-corn-corn silage-oat-alfalfa (3 years)	Acre
P_{13}	Wheat-corn silage-corn-flax-alfalfa (3 years)	Acre
P_{14}	Wheat-corn-flax-fallow	Acre
P_{15}	Wheat-corn-oat-fallow	Acre
P_{16}	Barley-corn-barley-alfalfa (3 years)	Acre
P_{17}	Barley-corn silage-barley-alfalfa (3 years)	Acre
P_{18}	Oat-corn-oat-alfalfa (3 years)	Acre
	Class b Land Rotations	
P_{19}	Corn-wheat	Acre
P_{20}	Corn-barley	Acre
P_{21}	Corn silage - barley	Acre
P_{22}	Corn-oats	Acre
P_{23}	Wheat-wheat-fallow	Acre
P_{24}	Flax-wheat-fallow	Acre
P_{25}	Wheat-corn-oat-alfalfa (3 years)	Acre
P_{26}	Wheat-corn silage-oat-alfalfa (3 years)	Acre
P_{27}	Flax-corn-oat-alfalfa (3 years)	Acre
P_{28}	Barley-corn-oat-alfalfa (3 years)	Acre
P_{29}	Corn silage-oat-alfalfa (3 years)	Acre
P_{30}	Barley-corn-barley-alfalfa (3 years)	Acre
P_{31}	Barley-corn silage-barley-alfalfa (3 years)	Acre
P_{32}	Oat-corn-oats-alfalfa (3 years)	Acre

Table 23 continued.

	Activity Description	Unit of Measure
	Cropland (continued)	
	Class c Land Rotations	
P_{33}	Wheat-corn-flax-alfalfa (3 years)	Acre
P_{34}	Wheat-corn-oat-alfalfa (3 years)	Acre
P_{35}	Flax-corn-oat-alfalfa (3 years)	Acre
P_{36}	Corn-oats-alfalfa (3 years)	Acre
P_{37}	Corn silage-oats-alfalfa (3 years)	Acre
P_{38}	Wheat-corn silage-oat-alfalfa (3 years)	Acre
P_{39}	Wheat-oat-alfalfa (4 years)	Acre
P_{40}	Wheat-oat-alfalfa (3 years)	Acre
P_{41}	Oat-corn-oat-alfalfa (3 years)	Acre
P_{42}	Oat-corn silage-oat-alfalfa (3 years)	Acre
P_{43}	Barley-corn-barley-alfalfa (3 years)	Acre
	Class d Land Rotations	
P_{44}	Wheat-wheat-fallow	Acre
P_{45}	Flax-wheat-fallow	Acre
P_{46}	Wheat-corn-oat-alfalfa (3 years)	Acre
P_{47}	Wheat-corn silage-oat-alfalfa (3 years)	Acre
P_{48}	Flax-corn-oat-alfalfa (3 years)	Acre
P_{49}	Barley-corn-oat-alfalfa (3 years)	Acre
P_{50}	Barley-corn silage-oats-alfalfa (3 years)	Acre
P_{51}	Oat-alfalfa (3 years)	Acre
P_{52}	Oat-corn-oat-alfalfa (3 years)	Acre
P_{53}	Oat-corn silage-oat-alfalfa (3 years)	Acre
P_{54}	Barley-corn-barley-alfalfa (3 years)	Acre
P_{55}	Native Hay	Acre
	Livestock Enterprises	
P_{56}	Beef-cow and calf	Cow - Calf
P_{57}	Stockers, silage-hay ration	Head
P_{58}	Stocker, grain-hay ration	Head
P_{59}	Feed calves in drylot, silage-hay	Head
P_{60}	Feed calves in drylot, grain-hay	Head
P_{61}	Feed calves on pasture, silage-hay	Head
P_{62}	Feed calves on pasture, grain-hay	Head

Table 23 continued.

	Activity Description	Unit of Measure
	Livestock Enterprises (continued)	
P_{63}	Feed yearlings: period one, silage-hay	Head
P_{64}	Feed yearlings: period one, no silage-hay	Head
P_{65}	Feed yearlings: period one and two, silage-hay	Two head
P_{66}	Feed yearlings: period one and two, grain-hay	Two head
P_{67}	Gilt and one litter	Sow-litter
	Purchase and Sale of Livestock	
P_{68}	Sell feeder calf	Head
P_{69}	Buy feeder calf	Head
P_{70}	Sell stocker	Head
P_{71}	Buy period one yearling	Head
P_{72}	Buy period two yearling	Head
P_{73}	Sell livestock	Hundred weight
	Hire Labor	
P_{74}	Hire period one labor	Hour
P_{75}	Hire period two labor	Hour
P_{76}	Hire period three labor	Hour
P_{77}	Hire period four labor	Hour
P_{78}	Hire period five labor	Hour
P_{79}	Borrow capital	Dollar
P_{80}	Feed feed grain	Corn equivalent
P_{81}	Sell feed grain	Corn equivalent
P_{82}	Sell wheat	Bushel
P_{83}	Sell flax	Bushel
P_{84}	Feed hay	Ton
P_{85}	Buy land	Acre

Table 24. Example of the Linear Programming Matrix Used to Determine Minimum Resource Combinations in Faulk County, South Dakota

Resource or Activity	Level	Class a Land Activities									
		P_{01}	P_{02}	P_{03}	P_{04}	P_{05}	P_{06}	P_{07}	P_{08}	P_{09}	P_{10}
R01	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
R02	0	0	0	0	0	0	0	0	0	0	0
R03	0	0	0	0	0	0	0	0	0	0	0
R04	0	0	0	0	0	0	0	0	0	0	0
R05	0	0	0	0	0	0	0	0	0	0	0
R06	0	0	0	0	0	0	0	0	0	0	0
R07	0	.50	.50	0	0	.33	.67	.33	0	.17	.17
R08	508	0	0	0	0	0	0	0	0	0	0
R09	210	.54	.54	.53	.53	.53	.54	.55	.36	.30	.27
R10	493	.93	.93	.94	.94	.94	.11	.10	.38	.88	.88
R11	583	.46	.740	.48	.75	.48	.90	.89	1.01	.75	.79
R12	306	.52	0	.52	0	.52	0	0	0	.29	.28
R13	0	-10.96	-13.87	-9.78	-12.68	-9.60	-5.03	-5.49	-5.65	-7.10	-7.54
R14	0	10.96	10.87	9.78	9.68	9.60	5.03	5.49	5.65	6.33	6.76
R15	0	0	0	0	0	0	0	0	0	-.85	-.85
R16	0	-8.40	0	-14.72	-6.32	-13.82	-3.62	0	0	-6.71	-4.91
R17	0	-9.75	-9.75	0	0	0	-7.00	-13.33	-6.33	0	-3.17
R18	0	0	0	0	0	0	0	0	-4.33	0	0
R19	0	0	0	0	0	0	0	0	0	0	0
R20	0	0	0	0	0	0	0	0	0	0	0
R21	0	0	-58.00	0	-58.00	0	0	0	0	0	0
R22	0	0	0	0	0	0	0	0	0	0	0
R23	0	0	0	0	0	0	0	0	0	0	0
R24	0	0	0	0	0	0	0	0	0	0	0
R25	0	0	0	0	0	0	0	0	0	0	0
R26	0	-13.32	-15.70	-12.12	-14.48	-11.94	-6.46	-7.87	-8.18	-8.71	-9.15
Minimum Land C_j											

Table 24 continued.

Resource or Activity	Class a Land Activities									
	P_{11}	P_{12}	P_{13}	P_{14}	P_{15}	P_{16}	P_{17}	P_{18}	P_{19}	P_{20}
R01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0	0
R02	0	0	0	0	0	0	0	0	1.00	1.00
R03	0	0	0	0	0	0	0	0	0	0
R04	0	0	0	0	0	0	0	0	0	0
R05	0	0	0	0	0	0	0	0	0	0
R06	0	0	0	0	0	0	0	0	0	0
R07	.17	.14	.14	.25	0	0	0	0	.50	0
R08	0	0	0	0	0	0	0	0	0	0
R09	.27	.23	.16	.27	.30	.30	.30	.30	.54	.53
R10	.88	.97	1.11	.71	.51	.88	.88	.88	.93	.94
R11	.88	.76	.77	.76	.67	.75	.84	.75	.46	.48
R12	.12	.24	.24	.30	.30	.29	.11	.29	.52	.52
R13	-8.41	-7.45	-7.50	-7.50	-6.66	-7.15	-8.12	-7.09	-10.24	-9.16
R14	6.64	7.45	7.85	77.50	6.66	6.38	6.34	6.31	10.24	9.16
R15	-.85	-.73	-.73	0	0	-.85	-.83	-.85	0	0
R16	-2.11	-3.95	-2.40	-4.20	-4.20	-7.02	-4.22	-6.31	-6.44	-11.91
R17	-3.14	-2.71	-2.71	-5.25	-5.25	0	0	0	-7.75	0
R18	0	0	-1.71	-3.00	0	0	0	0	0	0
R19	0	0	0	0	0	0	0	0	0	0
R20	0	0	0	0	0	0	0	0	0	0
R21	-10.10	-16.57	-16.57	0	0	0	-19.33	0	0	0
R22	0	0	0	0	0	0	0	0	0	0
R23	0	0	0	0	0	0	0	0	0	0
R24	0	0	0	0	0	0	0	0	0	0
R25	0	0	0	0	0	0	0	0	0	0
R26	-9.85	-10.58	-11.03	-9.29	-8.35	-8.76	-9.54	-8.69	-12.60	-11.50
Minimum Land C_j										

Table 24 continued.

Resource or Activity	Class b Land Activities											
	P_{21}	P_{22}	P_{23}	P_{24}	P_{25}	P_{26}	P_{27}	P_{28}	P_{29}	P_{30}	P_{31}	P_{32}
R01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
R02	0	0	0	0	0	0	0	0	0	0	0	0
R03	0	0	0	0	0	0	0	0	0	0	0	0
R04	0	0	0	0	0	0	0	0	0	0	0	0
R05	0	0	0	0	0	0	0	0	0	0	0	0
R06	0	0	0	0	0	0	0	0	0	0	0	0
R07	0	0	.67	.33	.17	.17	0	0	0	0	0	0
R08	0	0	0	0	0	0	0	0	0	0	0	0
R09	.53	.53	.55	.36	.27	.27	.26	.30	.21	.30	.30	.30
R10	.94	.94	.10	.38	.88	.88	.98	.88	1.03	.88	.88	.88
R11	.75	.48	.89	1.01	.79	.88	.81	.75	.82	.75	.84	.75
R12	0	.52	0	0	.28	.12	.29	.29	.03	.29	.11	.29
R13	-11.94	-8.97	-5.11	-5.35	-6.86	-7.77	-7.47	-6.52	-8.07	-6.60	-7.42	-6.55
R14	11.91	8.97	5.11	5.35	6.26	6.17	6.26	5.92	6.15	6.00	5.82	5.95
R15	0	0	0	0	-.67	-.67	-.67	-.67	-.82	-.67	-.67	-.67
R16	-5.47	-11.32	0	0	-3.78	-1.63	-3.78	-5.60	-1.95	-5.80	-3.64	-5.40
R17	0	0	-10.83	-5.18	-2.58	-2.58	0	0	0	0	0	0
R18	0	0	0	-3.67	0	0	-1.67	0	0	0	0	0
R19	0	0	0	0	0	0	0	0	0	0	0	0
R20	0	0	0	0	0	0	0	0	0	0	0	0
R21	-43.00	0	0	0	0	-14.33	0	0	-17.20	0	-14.33	0
R22	0	0	0	0	0	0	0	0	0	0	0	0
R23	0	0	0	0	0	0	0	0	0	0	0	0
R24	0	0	0	0	0	0	0	0	0	0	0	0
R25	0	0	0	0	0	0	0	0	0	0	0	0
R26	-13.72	-11.32	-6.47	-6.83	-8.46	-9.20	-8.54	-8.13	-9.38	-8.20	-8.58	-8.15
Minimum Land C_j												

Table 24 continued.

Resource on Activity	Class c Land Activities												
	P_{33}	P_{34}	P_{35}	P_{36}	P_{37}	P_{38}	P_{39}	P_{40}	P_{41}	P_{42}	P_{43}	P_{44}	P_{45}
R01	0	0	0	0	0	0	0	0	0	0	0	0	0
R02	0	0	0	0	0	0	0	0	0	0	0	0	0
R03	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
R04	0	0	0	0	0	0	0	0	0	0	0	0	0
R05	0	0	0	0	0	0	0	0	0	0	0	0	0
R06	0	0	0	0	0	0	0	0	0	0	0	0	0
R07	.17	.17	0	0	0	.17	.17	.20	0	0	0	.67	.33
R08	0	0	0	0	0	0	0	0	0	0	0	0	0
R09	.27	.27	.26	.21	.21	.27	.27	.32	.30	.30	.30	.55	.36
R10	1.02	1.88	.98	1.03	1.03	.88	.77	.72	.88	.88	.88	.10	.38
R11	.80	.79	.81	.71	.82	.88	.89	.90	.75	.84	.75	.89	1.01
R12	.32	.28	.29	.24	.03	.12	.03	.03	.29	.11	.29	0	0
R13	-7.27	-6.70	-6.86	-6.29	-7.43	-7.66	-5.80	-5.89	-6.48	-7.44	-6.40	-4.90	-5.15
R14	6.76	6.19	6.35	5.67	5.61	6.14	5.11	5.27	5.97	5.92	5.88	4.90	5.15
R15	-.58	-.58	-.58	-.69	-.69	-.58	-.74	-.69	-.58	-.58	-.58	0	0
R16	-2.24	-3.78	-3.78	-4.53	-1.84	-1.54	-1.54	-1.84	-5.32	-3.08	-3.64	0	0
R17	-2.50	-2.50	0	0	0	-2.50	-2.50	-3.00	0	0	0	-9.00	-4.50
R18	-1.83	0	-1.83	0	0	0	0	0	0	0	0	0	-3.67
R19	0	0	0	0	0	0	0	0	0	0	0	0	0
R20	0	0	0	0	0	0	0	0	0	0	0	0	0
R21	0	0	0	0	-18.00	-15.00	0	0	0	-15.00	0	0	0
R22	0	0	0	0	0	0	0	0	0	0	0	0	0
R23	0	0	0	0	0	0	0	0	0	0	0	0	0
R24	0	0	0	0	0	0	0	0	0	0	0	0	0
R25	0	0	0	0	0	0	0	0	0	0	0	0	0
R26	-8.95	-8.32	-8.53	-7.81	-8.74	-9.08	-7.12	-7.28	-8.09	-8.86	-8.00	-6.27	-6.63
Minimum Land C_j													

Table 24 continued.

Resource or Activity	Class d Land Activities								Native Hay
	P_{46}	P_{47}	P_{48}	P_{49}	P_{50}	P_{51}	P_{52}	P_{53}	P_{54}	P_{55}
R01	0	0	0	0	0	0	0	0	0	0
R02	0	0	0	0	0	0	0	0	0	0
R03	0	0	0	0	0	0	0	0	0	0
R04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0
R05	0	0	0	0	0	0	0	0	0	1.00
R06	0	0	0	0	0	0	0	0	0	.53
R07	.17	.17	0	0	0	0	0	0	0	0
R08	0	0	0	0	0	0	0	0	0	0
R09	.27	.27	.26	.30	.30	.26	.30	.30	.30	0
R10	.88	.88	.98	.88	.88	.86	.88	.88	.88	0
R11	.79	.88	.81	.75	.84	.89	.75	.84	.75	1.09
R12	.28	.12	.29	.29	.11	.04	.29	.11	.29	.04
R13	-6.70	-7.63	-6.82	-6.39	-7.31	-5.56	-6.48	-7.41	-6.39	-2.69
R14	6.10	6.03	6.22	5.79	5.71	4.66	5.88	5.81	5.79	2.02
R15	-.67	-.67	-.67	-.67	-.67	-1.05	-.67	-.67	-.67	-.67
R16	-3.22	-1.36	-3.22	-4.41	-2.55	-2.03	-4.58	-2.72	-4.26	0
R17	-2.17	-2.17	0	0	0	0	0	0	0	0
R18	0	0	-1.67	0	0	0	0	0	0	0
R19	0	0	0	0	0	0	0	0	0	0
R20	0	0	0	0	0	0	0	0	0	0
R21	0	-12.67	0	0	-12.67	0	0	0	0	0
R22	0	0	0	0	0	0	0	0	0	0
R23	0	0	0	0	0	0	0	0	0	0
R24	0	0	0	0	0	0	0	0	0	0
R25	0	0	0	0	0	0	0	0	0	0
R26	-8.31	-9.06	-8.49	-7.99	-8.74	-6.79	-8.08	-8.83	-7.99	-2.51
Minimum Land C_j										

Table 24 continued

Resource or Activity	Livestock Activities											
	P_{56}	P_{57}	P_{58}	P_{59}	P_{60}	P_{61}	P_{62}	P_{63}	P_{64}	P_{65}	P_{66}	P_{67}
R01	0	0	0	0	0	0	0	0	0	0	0	0
R02	0	0	0	0	0	0	0	0	0	0	0	0
R03	0	0	0	0	0	0	0	0	0	0	0	0
R04	0	0	0	0	0	0	0	0	0	0	0	0
R05	0	0	0	0	0	0	0	0	0	0	0	0
R06	6.50	3.25	3.25	0	0	2.50	2.50	0	0	0	0	0
R07	0	0	0	0	0	0	0	0	0	0	0	0
R08	6.26	2.36	2.36	2.52	2.52	2.03	2.03	3.52	3.52	3.52	3.52	2.53
R09	2.29	.78	.78	1.29	1.29	1.04	1.04	.88	.88	1.32	1.32	1.19
R10	1.38	.53	.53	3.10	3.10	2.50	2.50	0	0	2.20	2.20	5.58
R11	.90	.53	.53	1.92	1.92	1.56	1.56	0	0	2.20	2.20	3.97
R12	1.14	1.09	1.09	.75	.75	.60	.60	.88	.88	1.32	1.32	1.75
R13	-328.63	-173.43	-173.25	-199.76	-197.96	-196.02	-194.67	-248.75	-242.79	-274.51	-262.99	-342.06
R14	289.09	147.73	147.55	169.58	167.78	165.84	164.49	124.38	121.40	244.33	232.81	241.26
R15	0	0	0	0	0	0	0	0	0	0	0	.25
R16	0	0	0	0	0	0	0	0	0	0	0	0
R17	0	0	0	0	0	0	0	0	0	0	0	0
R18	0	0	0	0	0	0	0	0	0	0	0	0
R19	2.69	0	3.58	25.13	30.13	27.66	31.36	22.40	27.20	44.80	54.40	59.46
R20	52.00	8.00	12.80	12.18	16.18	18.75	20.40	3.20	7.20	6.40	14.40	0
R21	0	32.00	0	30.00	0	22.00	0	24.00	0	48.00	0	0
R22	-.76	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
R23	0	-1.00	-1.00	0	0	0	0	1.00	1.00	1.00	1.00	0
R24	0	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0
R25	-.90	0	0	-10.52	-10.52	-11.02	-11.02	-10.94	-10.94	-21.96	-21.96	-11.87
R26	-30.89	-19.42	-19.42	-41.93	-40.13	-37.94	-36.59	-37.60	-31.60	-67.31	-55.79	-101.62
Minimum Land C_j												

Table 24 continued

Resource or Activity	Buy and Sell Livestock						Hire Labor				Borrow Capital	
	P_{68}	P_{69}	P_{70}	P_{71}	P_{72}	P_{73}	P_{74}	P_{75}	P_{76}	P_{77}	P_{78}	P_{79}
R01	0	0	0	0	0	0	0	0	0	0	0	0
R02	0	0	0	0	0	0	0	0	0	0	0	0
R03	0	0	0	0	0	0	0	0	0	0	0	0
R04	0	0	0	0	0	0	0	0	0	0	0	0
R05	0	0	0	0	0	0	0	0	0	0	0	0
R06	0	0	0	0	0	0	0	0	0	0	0	0
R07	0	0	0	0	0	0	0	0	0	0	0	0
R08	0	0	0	0	0	0	-1.00	0	0	0	0	0
R09	0	0	0	0	0	0	0	-1.00	0	0	0	0
R10	0	0	0	0	0	0	0	0	-1.00	0	0	0
R11	0	0	0	0	0	0	0	0	0	-1.00	0	0
R12	0	0	0	0	0	0	0	0	0	0	-1.00	0
R13	0	0	0	0	0	0	-1.25	-1.25	-1.25	-1.25	-1.25	0
R14	0	0	0	0	0	0	1.25	1.25	1.25	1.25	1.25	-100.00
R15	0	0	0	0	0	0	0	0	0	0	0	0
R16	0	0	0	0	0	0	0	0	0	0	0	0
R17	0	0	0	0	0	0	0	0	0	0	0	0
R18	0	0	0	0	0	0	0	0	0	0	0	0
R19	0	0	0	0	0	0	0	0	0	0	0	0
R20	0	0	0	0	0	0	0	0	0	0	0	0
R21	0	0	0	0	0	0	0	0	0	0	0	0
R22	1.00	-1.00	0	0	0	0	0	0	0	0	0	0
R23	0	0	1.00	-1.00	0	0	0	0	0	0	0	0
R24	0	0	0	0	-1.00	0	0	0	0	0	0	0
R25	-4.43	4.51	-6.56	6.70	6.76	1.00	0	0	0	0	0	0
R26	0	0	0	0	0	24.10	0	0	0	0	0	0
Minimum Land C_j												

Table 24 continued

Resource or Activity	P_{80}	P_{81}	P_{82}	P_{83}	P_{84}	P_{85}
R01	0	0	0	0	0	-.1045
R02	0	0	0	0	0	-.2088
R03	0	0	0	0	0	-.0955
R04	0	0	0	0	0	-.0256
R05	0	0	0	0	0	-.125
R06	0	0	0	0	0	-.2412
R07	0	0	0	0	0	-.113
R08	0	0	0	0	0	0
R09	0	0	0	0	0	0
R10	0	0	0	0	0	0
R11	0	0	0	0	0	0
R12	0	0	0	0	0	0
R13	0	0	0	0	0	0
R14	0	0	0	0	0	0
R15	0	0	0	0	1.00	0
R16	56.00	5.60	0	0	0	0
R17	0	0	1.00	0	0	0
R18	0	0	0	1.00	0	0
R19	-56.00	0	0	0	0	0
R20	0	0	0	0	-20.00	0
R21	0	0	0	0	0	0
R22	0	0	0	0	0	0
R23	0	0	0	0	0	0
R24	0	0	0	0	0	0
R25	0	0	0	0	0	0
R26	0	10.94	1.82	2.75	0	varies
Minimum Land C_j						-1.00